

**New Carboxamide Compounds having Melanin Concentrating Hormone  
Antagonistic Activity, Pharmaceutical Preparations Comprising these  
Compounds and Process for their Manufacture**

**5 Related Applications**

The priority benefit of DE 102 38 865.2, filed August 24, 2002 and U.S. Provisional Application No. 60/408,224, filed September 4, 2002 are hereby claimed, both of which are incorporated by reference herein.

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The present invention relates to new carboxamide compounds, processes for preparing them and the physiologically acceptable salts thereof as well as their use as MCH antagonists and their use in preparing a pharmaceutical preparation which is suitable for the prevention and/or treatment of symptoms and/or diseases caused by MCH or causally connected with MCH in some other way. The invention further relates to the use of a compound according to the invention for influencing eating behaviour and for reducing body weight and/or for preventing an increase in the body weight of a mammal. The invention also relates to compositions and medicaments containing a compound according to the invention, and a process for preparing them.

**Background to the Invention**

The intake of food and its conversion in the body is an essential part of life for all living creatures. Therefore, deviations in the intake and conversion of food generally lead to problems and also illness. The changes in the lifestyle and nutrition of humans, particularly in industrialised countries, have promoted obesity in recent decades. In affected people, obesity leads directly to restricted mobility and a reduction in the quality of life. There is the additional factor that obesity often leads to other diseases such as, for example, diabetes, dyslipidaemia, high blood pressure, arteriosclerosis and coronary heart disease. Moreover, high body

weight alone puts an increased strain on the support and mobility apparatus, which can lead to chronic pain and diseases such as arthritis or osteoarthritis. Thus, obesity is a serious health problem for society.

- 5     The term obesity means an excess of adipose tissue. In this connection, obesity is fundamentally to be seen as the increased level of body fat which leads to a health risk. In the last analysis it is not precisely possible to draw a distinction between normal individuals and those suffering from obesity, but the health risk accompanying obesity is presumed to rise continuously as the level of body fat increases. For simplicity's sake, in the present invention, individuals with a Body Mass Index (BMI), which is defined as the body weight measured in kilograms divided by the height (in metres) squared, above a value of 25 and more particularly above 30 are preferably regarded as suffering from obesity.
- 10
- 15    Apart from physical activity and a change in nutrition, there is currently no convincing treatment option for effectively reducing body weight. However, as obesity is a major risk factor in the development of serious and even life-threatening diseases, it is all the more important to have access to pharmaceutical active substances for the prevention and/or treatment of obesity. One approach which has been proposed very recently is the therapeutic use of MCH antagonists (cf. *inter alia* WO 01/21577, WO 01/82925).
- 20

- 25    Melanin-concentrating hormone (MCH) is a cyclic neuropeptide consisting of 19 amino acids. It is synthesised predominantly in the hypothalamus in mammals and from there travels to other parts of the brain by the projections of hypothalamic neurones. Its biological activity is mediated in humans through two different glycoprotein-coupled receptors (GPCRs) from the family of rhodopsin-related GPCRs, namely the MCH receptors 1 and 2 (MCH-1R, MCH-2R).
- 30    Investigations into the function of MCH in animal models have provided good indications for a role of the peptide in regulating the energy balance, i.e. changing

metabolic activity and food intake [1,2]. For example, after intraventricular administration of MCH in rats, food intake was increased compared with control animals. Additionally, transgenic rats which produce more MCH than control animals, when given a high-fat diet, responded by gaining significantly more weight than animals without an experimentally altered MCH level. It was also found that there is a positive correlation between phases of increased desire for food and the quantity of MCH mRNA in the hypothalamus of rats. However, experiments with MCH knock-out mice are particularly important in showing the function of MCH. Loss of the neuropeptide results in lean animals with a reduced fat mass, which take in significantly less food than control animals.

The anorectic effects of MCH are mediated in rodents through the G<sub>vs</sub>-coupled MCH-1R [3-6]. Unlike primates, ferrets and dogs, no second receptor has hitherto been found in rodents. After losing the MCH-1R, knock-out mice have a lower fat mass, an increased energy conversion and, when fed on a high fat diet, do not put on weight, compared with control animals. Another indication of the importance of the MCH-MCH-1R system in regulating the energy balance results from experiments with a receptor antagonist (SNAP-7941) [3]. In long term trials the animals treated with the antagonist lose significant amounts of weight.

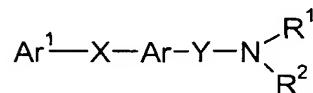
In addition to its anorectic effect, the MCH-1R antagonist SNAP-7941 also achieves additional anxiolytic and antidepressant effects in behavioural experiments on rats [3]. Thus, there are clear indications that the MCH-MCH-1R system is involved not only in regulating the energy balance but also in affectivity.

Literature:

1. Qu, D., et al., *A role for melanin-concentrating hormone in the central regulation of feeding behaviour*. Nature, 1996. **380**(6571): p. 243-7.
2. Shimada, M., et al., *Mice lacking melanin-concentrating hormone are hypophagic and lean*. Nature, 1998. **396**(6712): p. 670-4.

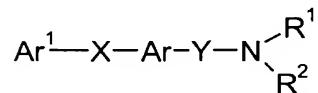
3. Borowsky, B., et al., *Antidepressant, anxiolytic and anorectic effects of a melanin-concentrating hormone-1 receptor antagonist*. Nat Med, 2002. **8**(8): p. 825-30.
4. Chen, Y., et al., *Targeted disruption of the melanin-concentrating hormone receptor-1 results in hyperphagia and resistance to diet-induced obesity*. Endocrinology, 2002. **143**(7): p. 2469-77.
5. Marsh, D.J., et al., *Melanin-concentrating hormone 1 receptor-deficient mice are lean, hyperactive, and hyperphagic and have altered metabolism*. Proc Natl Acad Sci U S A, 2002. **99**(5): p. 3240-5.
- 10 6. Takekawa, S., et al., *T-226296: A novel, orally active and selective melanin-concentrating hormone receptor antagonist*. Eur J Pharmacol, 2002. **438**(3): p. 129-35.

In the patent literature certain amine compounds are proposed as MCH antagonists. Thus, WO 01/21577 (Takeda) describes compounds of formula



wherein  $\text{Ar}^1$  denotes a cyclic group ,  $\text{X}$  denotes a spacer,  $\text{Y}$  denotes a bond or a spacer,  $\text{Ar}$  denotes an aromatic ring which may be fused with a non-aromatic ring,  $\text{R}^1$  and  $\text{R}^2$  independently of one another denote H or a hydrocarbon group, while  $\text{R}^1$  and  $\text{R}^2$  together with the adjacent N atom may form an N-containing hetero ring and  $\text{R}^2$  with  $\text{Ar}$  may also form a spirocyclic ring,  $\text{R}$  together with the adjacent N atom and  $\text{Y}$  may form an N-containing hetero ring, as MCH antagonists for the treatment of obesity.

25 Moreover WO 01/82925 (Takeda) also describes compounds of formula

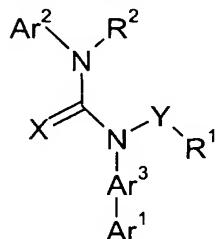


wherein  $\text{Ar}^1$  denotes a cyclic group ,  $\text{X}$  and  $\text{Y}$  represent spacer groups,  $\text{Ar}$  denotes an optionally substituted fused polycyclic aromatic ring,  $\text{R}^1$  and  $\text{R}^2$  independently

of one another represent H or a hydrocarbon group, while R<sup>1</sup> and R<sup>2</sup> together with the adjacent N atom may form an N-containing heterocyclic ring and R<sup>2</sup> together with the adjacent N atom and Y may form an N-containing hetero ring, as MCH antagonists for the treatment of obesity.

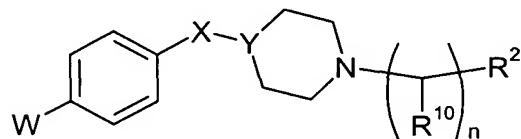
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Other amine-compounds having an MCH-antagonistic activity are proposed in WO 02/057233 (Schering Corp.). The compounds come under general formula



wherein Ar<sup>1</sup>, Ar<sup>2</sup>, Ar<sup>3</sup> denote *inter alia* aryl or heteroaryl, X O, S or N-CN, Y denotes a single bond or C<sub>1-4</sub>-alkylene and R<sup>1</sup> and R<sup>2</sup> are as herein defined.

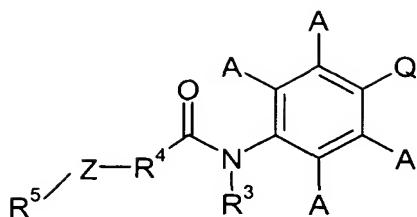
Also a MCH-antagonistic activity is described in WO 02/051809 (Schering Corp.) in connection with piperidine derivatives of formula



15 wherein W denotes a specifically defined aminocarbonyl or carbonylamino group, X denotes -CHR<sup>8</sup>, -CO, -C(NOR<sup>9</sup>) or -CR<sup>8</sup>=, Y denotes CH, C(OH), C(C<sub>1-4</sub>-alkoxy) or in the case of a C double bond, R<sup>2</sup> denotes a substituted aryl or heteroaryl group, R<sup>10</sup> denotes H, C<sub>1-6</sub>-alkyl or aryl and the other groups are as herein defined.

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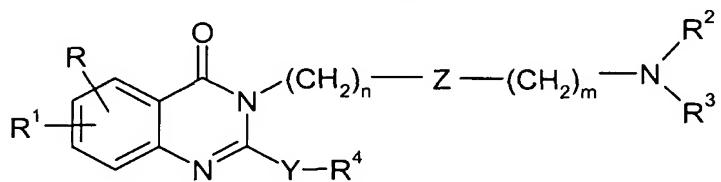
Carboxamides as antagonists of the human 11CB<sub>y</sub> receptors are proposed in WO 02/10146 (Smithkline Beecham). The compounds are examples of the general structural formula



- wherein A denotes H, alkyl, alkoxy, alkenyl, acyl, halogen, OH, CN or  $\text{CF}_3$ ,  $\text{R}^3$  denotes H, methyl or ethyl,  $\text{R}^4$  denotes an optionally substituted aromatic carbocyclic or heterocyclic ring, Z denotes O, S, NH,  $\text{CH}_2$  or a single bond,  $\text{R}^5$  denotes an optionally substituted aromatic, saturated or unsaturated carbocyclic or heterocyclic ring, Q denotes the group  $-\text{X}-\text{Y}-\text{NR}^1(\text{R}^2)$ , while according to different configurations X may denote O, S or N, Y may denote an alkylene or a cycloalkylene group which may also be substituted, and  $\text{R}^1$  and  $\text{R}^2$  may represent alkyl or phenyl-alkyl, while  $\text{R}^1$  and  $\text{R}^2$ ,  $\text{R}^1$  and Y or  $\text{R}^1$  and X may also be connected to one another to form a cyclic system, as described.

Other compounds with MCH-antagonistic properties are proposed in the published applications WO 03/035055, WO 03/033480, WO 02/06245, WO 02/04433, WO 15 01/87834, WO 01/21169 and JP 2001/226269.

Quinazolinone compounds of general formula

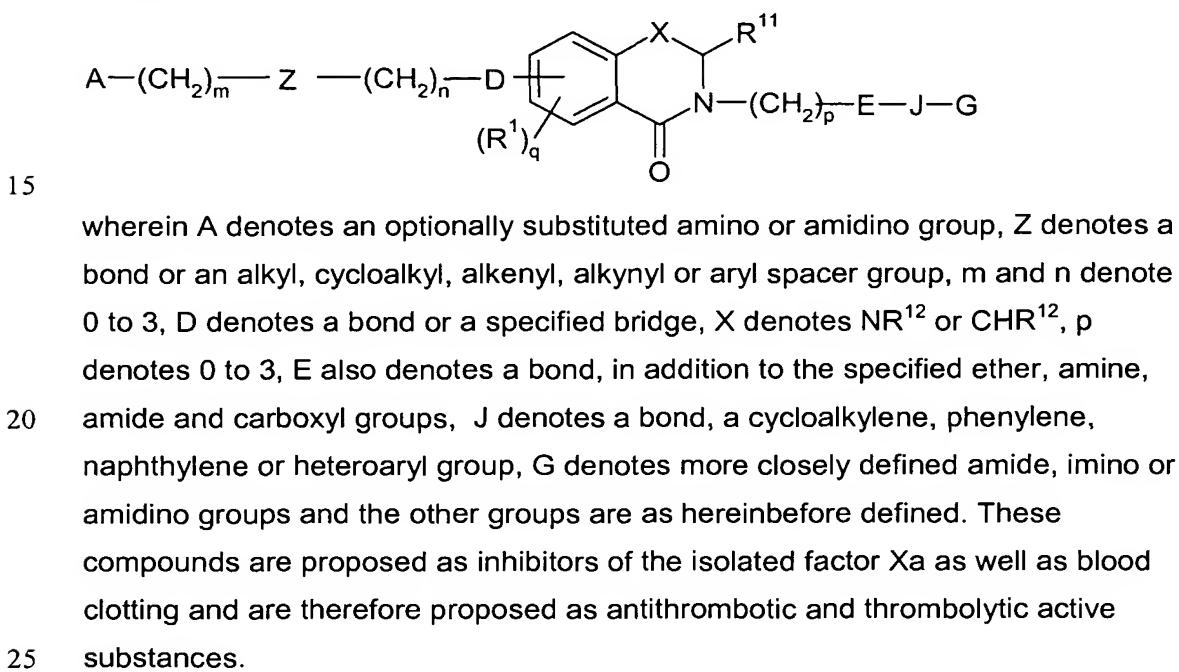


- 20 are described in WO 01/23365 (Merck), wherein Z denotes a bond or phenylene, and in WO 01/23364 (Merck), wherein Z denotes cyclohexylene. Moreover Y represents a bond or  $\text{C}_{2-4}$ -alkenyl and  $\text{R}^4$  denotes aryl, cycloalkyl, phenylalkyl or a heterocyclic system. These compounds are described as GPIbIX inhibitors,

particularly as inhibitors of this receptor with the von Willebrand factor (vWF) ligand.

- Aromatic compounds which may contain an amide bridge and an amine group are
- 5 also proposed in the literature for other indications. Thus, compounds of general formula Ar-A-E, wherein Ar denotes an optionally substituted aromatic mono- or bicyclic group, A denotes an amide or amine bridge and E denotes *inter alia* a phenyl group which is substituted in the para position via a spacer group B with a substituted aminoalkylene group, are described in WO 99/01127 (Smithkline Beecham Corp.). These compounds are proposed as CCR5 receptor ligands for
- 10 the treatment *inter alia* of asthma, atopic diseases and rheumatoid arthritis.

WO 01/72712 (Cor Therapeutics Inc.) describes isoquinoline compounds of the following formula



DE 197 18 181 A1 (Boehringer Ingelheim) proposes disubstituted bicyclic heterocycles of formula

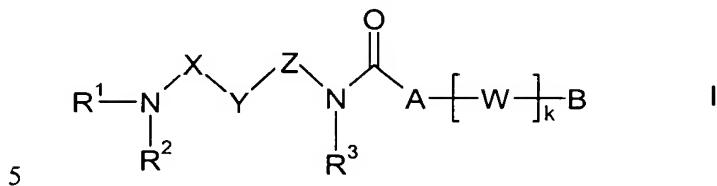


wherein  $R_a$  may denote one of a number of more closely defined amino groups or optionally also an  $R_4\text{-SO}_2\text{-NR}_5$  or an  $R_4\text{-SO}_2$  group having the meanings given for  $R_4$  and  $R_5$ , A denotes a phenylene-C<sub>1-3</sub>-alkylene group, an n-C<sub>2-6</sub>-alkylene group or 5 a C<sub>5-7</sub>-cycloalkylene-C<sub>1-3</sub>-alkylene group which may be substituted as specified, Het denotes an optionally substituted benzimidazole, indole, tetrahydroquinolinone or quinazolinone group, Ar denotes an optionally substituted phenylene, naphthylene, thienylene, thiazolylene, pyridinylene, pyrimidinylene, pyrazinylene or 10 pyridazinylene group and E denotes a cyano or  $R_b\text{NH-C(=NH)}$  group, wherein  $R_b$  denotes H, OH, C<sub>1-3</sub>-alkyl or a group which can be cleaved in vivo. These compounds are proposed as thrombin-inhibiting and thrombin-time prolonging active substances.

### **Summary of the invention**

15 The present invention provides new carboxamide compounds, particularly those which are effective as MCH antagonists. The invention also sets out to provide new carboxamide compounds which can be used to influence the eating habits of mammals and achieve a reduction in body weight, particularly in mammals and/or prevent an increase in body weight. The present invention further sets out to 20 provide new pharmaceutical compositions which are suitable for the prevention and/or treatment of symptoms and/or diseases caused by MCH or otherwise causally connected to MCH. In particular, this invention provides pharmaceutical compositions for the treatment of metabolic disorders such as obesity and/or diabetes as well as diseases and/or disorders which are associated with obesity 25 and diabetes. Other objectives of the present invention are concerned with demonstrating advantageous uses of the compounds according to the invention. The invention also sets out to provide a process for preparing the carboxamide compounds according to the invention. Other aims of the present invention will be immediately apparent to one skilled in the art from the foregoing remarks and 30 those that follow.

A first object of the present invention comprises carboxamide compounds of general formula I



wherein

10      R<sup>1</sup>, R<sup>2</sup>    independently of one another denote H, a C<sub>1-8</sub>-alkyl or C<sub>3-7</sub>-cycloalkyl group optionally substituted by the group R<sup>11</sup> or a phenyl group optionally mono- or polysubstituted by the group R<sup>12</sup> and/or monosubstituted by nitro , or

15      R<sup>1</sup> and R<sup>2</sup> form a C<sub>2-8</sub>-alkylene bridge wherein  
- one or two -CH<sub>2</sub>-groups may be replaced independently of one another by -CH=N- or -CH=CH- and/or  
- one or two -CH<sub>2</sub>-groups may be replaced independently of one another by -O-, -S-, -CO-, -C(=CH<sub>2</sub>)- or -NR<sup>13</sup>- so that heteroatoms are not directly connected to one another,

20      while in the alkylene bridge defined above one or more H atoms may be replaced by R<sup>14</sup>, and/ or

25      the alkylene bridge defined above may be substituted by one or two identical or different carbo- or heterocyclic groups Cy in such a way that the bond between the alkylene bridge and the group Cy is formed  
- via a single or double bond,  
- via a common C atom forming a spirocyclic ring system,

- via two common, adjacent C and/or N atoms forming a fused bicyclic ring system or
- via three or more C and/or N atoms forming a bridged ring system,

|    |       |   |
|----|-------|---|
| 5  | $R^3$ | denotes H, $C_{1-6}$ -alkyl, $C_{3-7}$ -cycloalkyl, $C_{3-7}$ -cycloalkyl- $C_{1-4}$ -alkyl-, $C_{3-7}$ -cycloalkenyl, $C_{3-7}$ -cycloalkenyl- $C_{1-4}$ -alkyl-, phenyl, phenyl- $C_{1-4}$ -alkyl-, $C_{1-3}$ -alkoxy- $C_{2-6}$ -alkyl-, amino- $C_{2-6}$ -alkyl-, $C_{1-3}$ -alkyl-amino- $C_{2-6}$ -alkyl- or di-( $C_{1-3}$ -alkyl)-amino- $C_{2-6}$ -alkyl-,   |
| 10 | X     | denotes a single bond or a $C_{1-8}$ -alkylene bridge wherein <ul style="list-style-type: none"><li>- one or two -<math>CH_2</math>-groups may be replaced independently of one another by -<math>CH=CH</math>- or -<math>C\equiv C</math>- and/or</li><li>- one or two -<math>CH_2</math>-groups may be replaced independently of one another by -O-, -S-, -(SO)-, -(SO<sub>2</sub>)-, -CO- or -NR<sup>4</sup>- in such a way that in each case two O, S or N atoms or one O atom and an S atom are not directly connected with one another,</li></ul> |
| 15 |       | while one or two C atoms independently of one another may be substituted by a hydroxy, $\omega$ -hydroxy- $C_{1-3}$ -alkyl-, $\omega$ -( $C_{1-3}$ -alkoxy)- $C_{1-3}$ -alkyl- and/or $C_{1-3}$ -alkoxy group and/or in each case with one or two identical or different $C_{1-6}$ -alkyl groups, and/or  |
| 20 |       | the alkylene bridge may be connected to $R^1$ so as to include the N atom connected to $R^1$ and X, forming a heterocyclic group,   |
| 25 | Z     | denotes a $C_{1-4}$ -alkylene bridge, wherein two adjacent C atoms with an additional $C_{1-4}$ -alkylene bridge may be connected to one another, while in group Z a - $CH_2$ -group may be replaced by -O- or -NR <sup>5</sup> -,  |
| 30 |       | and one or two C atoms of the alkylene bridge may be substituted independently of one another with a hydroxy, $\omega$ -hydroxy- $C_{1-3}$ -alkyl-,   |

$\omega$ -(C<sub>1-3</sub>-alkoxy)-C<sub>1-3</sub>-alkyl-, C<sub>1-3</sub>-alkoxy group, amino-C<sub>1-3</sub>-alkyl-, C<sub>1-3</sub>-alkyl-amino-C<sub>1-3</sub>-alkyl- or di-(C<sub>1-3</sub>-alkyl)-amino-C<sub>1-3</sub>-alkyl- and/or with one or two identical or different C<sub>1-6</sub>-alkyl groups, and/or

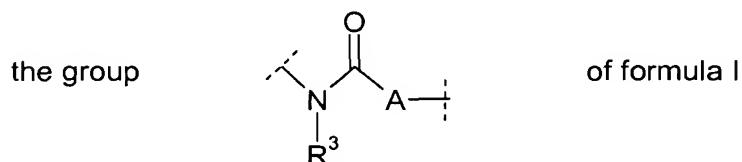
5 R<sup>3</sup> may be connected to Z so as to include the N atom connected to R<sup>3</sup>, forming a heterocyclic group,

A, Y independently of one another have one of the meanings given for Cy,

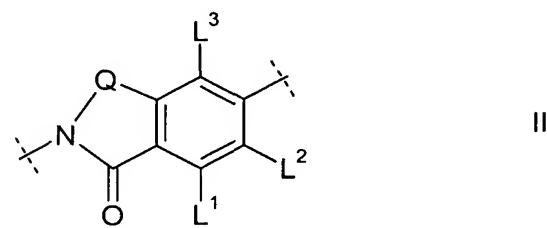
10 while R<sup>1</sup> may be connected to Y so as to include the group X and the N atom connected to R<sup>1</sup> and X, forming a heterocyclic group fused to Y, and/or

15 R<sup>3</sup> may be connected to Y so as to include the group Z and the N atom connected to R<sup>3</sup> and Z, forming a saturated or partially unsaturated heterocyclic group fused to Y, or

A and R<sup>3</sup> may be connected to one another in such a way that



20 denotes a group of partial formula II



and

Q denotes a group, selected from the partial formulae IIIa to IIIg

|                                     |       |
|-------------------------------------|-------|
| —CR <sup>6</sup> R <sup>7</sup> —   | IIIa  |
| —CR <sup>6</sup> —CR <sup>7</sup> — | IIIb  |
| —N=CR <sup>8</sup> —                | IIIc  |
| —N=N—                               | IIId  |
| —CO—NR <sup>9</sup> —               | IIIe  |
| —CR <sup>8</sup> =N—                | IIIIf |
| —CO—                                | IIIg  |

5

L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> independently of one another have one of the meanings given for R<sup>20</sup>,

B denotes C<sub>1-6</sub>-alkyl, C<sub>1-6</sub>-alkenyl, C<sub>1-6</sub>-alkynyl, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkyl-,  
C<sub>3-7</sub>-cycloalkenyl-C<sub>1-3</sub>-alkyl-, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkenyl- or C<sub>3-7</sub>-

10 cycloalkyl-C<sub>1-3</sub>-alkynyl-, wherein one or more C atoms may be mono- or polysubstituted by halogen and/ or monosubstituted by hydroxy or cyano and/ or cyclic groups may be mono- or polysubstituted by R<sup>20</sup>, or

15 has one of the meanings given for Cy, while the bond to the group W or optionally directly to the group A is formed via a C atom of the carbocyclic moiety or of the optionally fused-on phenyl or pyridine ring or via an N or C atom of the heterocyclic moiety,

20 while when k=0 the group B and the group A may be connected to one another via a common C atom forming a spirocyclic ring system or

via two common, adjacent atoms forming a fused, bicyclic ring system,

|    |   |
|----|---|
| W  | denotes a single bond, -O-, a C <sub>1-4</sub> -alkylene, C <sub>2-4</sub> -alkenylene, C <sub>2-4</sub> -alkynylene, C <sub>1-4</sub> -alkylenoxy, Oxy-C <sub>1-4</sub> -alkylene, C <sub>1-3</sub> -alkylene-oxy-C <sub>1-3</sub> -alkylene-, imino, N-(C <sub>1-3</sub> -alkyl)-imino-, imino-C <sub>1-4</sub> -alkylene-, N-(C <sub>1-3</sub> -alkyl)-imino-C <sub>1-4</sub> -alkylene-, C <sub>1-4</sub> -alkylene-imino- or C <sub>1-4</sub> -alkylene-N-(C <sub>1-3</sub> -alkyl)-imino-group,   |
| 5  |   |
| 10 | while one or two C atoms independently of one another may be substituted by a hydroxy, ω-hydroxy-C <sub>1-3</sub> -alkyl-, ω-(C <sub>1-3</sub> -alkoxy)-C <sub>1-3</sub> -alkyl- and/or C <sub>1-3</sub> -alkoxy group and/or with one or two identical or different C <sub>1-6</sub> -alkyl groups, and/or   |
| 15 |   |
| 20 | W with the definitions alkylene, oxyalkylene and alkyleneoxyalkylene may also be connected to B via a double bond,  |
| 25 |   |
| 30 | k denotes 0 or 1,   |
| Cy | denotes a carbo- or heterocyclic group selected from one of the following definitions   |
| 20 | <ul style="list-style-type: none"><li>- a saturated 3- to 7-membered carbocyclic group,</li><li>- an unsaturated 5- to 7-membered carbocyclic group,</li><li>- a phenyl group,</li><li>- a saturated 4- to 7-membered or unsaturated 5- to 7-membered heterocyclic group with an N, O or S atom as heteroatom,</li><li>- a saturated or unsaturated 5- to 7-membered heterocyclic group with two or more N atoms or with one or two N atoms and an O or S atom as heteroatoms,</li><li>- an aromatic heterocyclic 5- or 6-membered group with one or more identical or different heteroatoms selected from N, O and/or S,</li></ul> |
| 25 |   |
| 30 |   |

while the above mentioned 4-, 5-, 6- or 7-membered groups may be connected via two common, adjacent C atoms, fused with a phenyl or pyridine ring, and

5 in the above mentioned 5-, 6- or 7-membered groups one or two non-adjacent -CH<sub>2</sub> groups may be replaced by a -CO-, -C(=CH<sub>2</sub>)-, -(SO)- or -(SO<sub>2</sub>)- group, and

10 the above mentioned saturated 6- or 7-membered groups may also be present as bridged ring systems with an imino, N-(C<sub>1-4</sub>-alkyl)-imino, methylene, C<sub>1-4</sub>-alkyl-methylene- or di-(C<sub>1-4</sub>-alkyl)-methylene-bridge, and

15 the above mentioned cyclic groups may be mono- or polysubstituted at one or more C atoms with R<sup>20</sup>, and in the case of a phenyl group also additionally monosubstituted by nitro, and/or substituted by R<sup>21</sup> at one or more N atoms,

20 R<sup>4</sup>, R<sup>5</sup> independently of one another have one of the meanings given for R<sup>16</sup>,

R<sup>6</sup>, R<sup>7</sup>,

25 R<sup>8</sup>, R<sup>9</sup> independently of one another denote H, a C<sub>1-6</sub>-alkyl,  $\omega$ -C<sub>1-3</sub>-alkoxy-C<sub>1-3</sub>-alkyl- or  $\omega$ -hydroxy-C<sub>1-3</sub>-alkyl-group and R<sup>6</sup>, R<sup>7</sup>, R<sup>8</sup> independently of one another also denote halogen,

30 R<sup>11</sup> denotes R<sup>15</sup>-O-, R<sup>15</sup>-O-CO-, R<sup>16</sup>R<sup>17</sup>N-, R<sup>18</sup>R<sup>19</sup>N-CO- or Cy-,

R<sup>12</sup> has one of the meanings given for R<sup>20</sup>,

35 R<sup>13</sup> has one of the meanings given for R<sup>17</sup>,

|    |                     |   |
|----|---------------------|---|
|    | $R^{14}$            | denotes halogen, $C_{1-6}$ -alkyl, $R^{15}$ -O-, $R^{15}$ -O-CO-, $R^{16}R^{17}N$ -, $R^{18}R^{19}N$ -CO-, $R^{15}$ -O- $C_{1-3}$ -alkyl-, $R^{15}$ -O-CO- $C_{1-3}$ -alkyl-, $R^{16}R^{17}N$ - $C_{1-3}$ -alkyl-, $R^{18}R^{19}N$ -CO- $C_{1-3}$ -alkyl- or Cy- $C_{1-3}$ -alkyl-,   |
| 5  | $R^{15}$            | denotes H, $C_{1-4}$ -alkyl, $C_{3-7}$ -cycloalkyl, $C_{3-7}$ -cycloalkyl- $C_{1-3}$ -alkyl-, phenyl, phenyl- $C_{1-3}$ -alkyl- or pyridinyl,   |
| 10 | $R^{16}$            | denotes H, $C_{1-6}$ -alkyl, $C_{3-7}$ -cycloalkyl, $C_{3-7}$ -cycloalkyl- $C_{1-3}$ -alkyl-, $C_{4-7}$ -cycloalkenyl, $C_{4-7}$ -cycloalkenyl- $C_{1-3}$ -alkyl-, $\omega$ -hydroxy- $C_{2-3}$ -alkyl-, $\omega$ -( $C_{1-3}$ -alkoxy)- $C_{2-3}$ -alkyl-, amino- $C_{1-6}$ -alkyl-, $C_{1-3}$ -alkyl-amino- $C_{1-6}$ -alkyl- or di-( $C_{1-3}$ -alkyl)-amino- $C_{1-6}$ -alkyl-, |
| 15 | $R^{17}$            | has one of the meanings given for $R^{16}$ or denotes phenyl, phenyl- $C_{1-3}$ -alkyl-, pyridinyl, dioxolan-2-yl, $C_{1-3}$ -alkylcarbonyl, hydroxycarbonyl- $C_{1-3}$ -alkyl-, $C_{1-4}$ -alkoxycarbonyl, $C_{1-3}$ -alkylcarbonylamino- $C_{2-3}$ -alkyl-, $C_{1-3}$ -alkylsulphonyl- or $C_{1-3}$ -alkylsulphonylamino- $C_{2-3}$ -alkyl-,                                      |
| 20 | $R^{18}$ , $R^{19}$ | independently of one another denote H or $C_{1-6}$ -alkyl,  |
| 20 | $R^{20}$            | denotes halogen, hydroxy, cyano, $C_{1-4}$ -alkyl, $C_{3-7}$ -cycloalkyl, hydroxy- $C_{1-3}$ -alkyl, $R^{22}$ - $C_{1-3}$ -alkyl- or has one of the meanings given for $R^{22}$ ,   |
| 25 | $R^{21}$            | denotes $C_{1-3}$ -alkyl, $\omega$ -hydroxy- $C_{2-3}$ -alkyl, phenyl, phenyl- $C_{1-3}$ -alkyl-, $C_{1-3}$ -alkyl-carbonyl, carboxy, $C_{1-4}$ -alkoxy-carbonyl, $C_{1-3}$ -alkylsulphonyl, phenylcarbonyl or phenyl- $C_{1-3}$ -alkyl-carbonyl,   |
| 30 | $R^{22}$            | denotes pyridinyl, phenyl, phenyl- $C_{1-3}$ -alkoxy-, $C_{1-3}$ -alkoxy, $C_{1-3}$ -alkylthio-, carboxy, H-CO-, $C_{1-3}$ -alkylcarbonyl, $C_{1-4}$ -alkoxycarbonyl, aminocarbonyl, $C_{1-3}$ -alkylaminocarbonyl, di-( $C_{1-3}$ -alkyl)-aminocarbonyl, $C_{1-3}$ -alkyl-sulphonyl, $C_{1-3}$ -alkyl-sulphinyl, $C_{1-3}$ -alkyl-sulphonylamino-,                                 |

amino-, C<sub>1-3</sub>-alkylamino-, di-(C<sub>1-3</sub>-alkyl)-amino-, phenyl-C<sub>1-3</sub>-alkylamino- or N-(C<sub>1-3</sub>-alkyl)-phenyl-C<sub>1-3</sub>-alkylamino-, acetylamino-, propionylamino-, phenylcarbonyl, phenylcarbonylamino-, phenylcarbonylmethylamino-, hydroxyalkylaminocarbonyl, (4-morpholinyl)carbonyl, (1-pyrrolidinyl)- carbonyl, (1-piperidinyl)carbonyl, (hexahydro-1-azepinyl)carbonyl, (4-methyl-1-piperazinyl)carbonyl, methylenedioxy, aminocarbonylamino- or alkylaminocarbonylamino-,

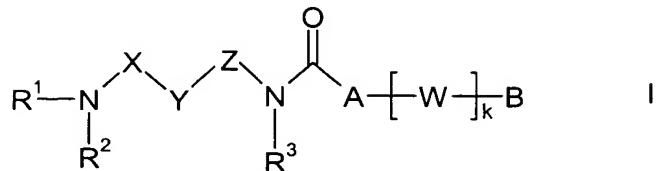
while in the groups and residues A, B, W, X, Y, Z, R<sup>1</sup> to R<sup>9</sup> and R<sup>11</sup> to R<sup>22</sup> in each case one or more C atoms may be mono- or polysubstituted by F and/or in each case one or two C atoms independently of one another may be monosubstituted by Cl or Br, and/or in each case one or more phenyl rings independently of one another additionally have one, two or three substituents selected from the group F, Cl, Br, I, C<sub>1-4</sub>-alkyl, C<sub>1-4</sub>-alkoxy, difluoromethyl, trifluoromethyl, hydroxy, amino, C<sub>1-3</sub>-alkylamino-, di-(C<sub>1-3</sub>-alkyl)-amino-, acetylamino-, aminocarbonyl, CN, difluoromethoxy, trifluoromethoxy, amino-C<sub>1-3</sub>-alkyl-, C<sub>1-3</sub>-alkylamino-C<sub>1-3</sub>-alkyl- and di-(C<sub>1-3</sub>-alkyl)-amino-C<sub>1-3</sub>-alkyl- and/or may be monosubstituted by nitro, and

the H atom of any carboxy group present or an H atom bound to an N atom may be replaced in each case by a group which can be cleaved in vivo,

the tautomers, diastereomers, enantiomers, mixtures thereof and the salts thereof.

The invention also relates to the compounds in the form of the individual optical isomers, mixtures of the individual enantiomers or racemates, in the form of the tautomers and in the form of the free bases or the corresponding acid addition salts with pharmacologically acceptable acids. The subject of the invention also includes the compounds according to the invention, including their salts, wherein one or more hydrogen atoms are replaced by deuterium.

The invention further relates to a process for preparing carboxamide compounds of formula I



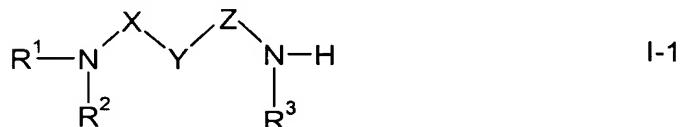
5

wherein A, B, W, X, Y, Z, R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> and k have one of the meanings given hereinbefore, where

if A denotes a group R<sup>3</sup> which is not connected to the group A:

10

- a) in the event that A denotes a nitrogen-heterocyclic group connected to the carboxamide group via a nitrogen atom which may also have in addition to the nitrogen atom one or more heteroatoms selected from N, O and S, at least one amine compound of formula I-1

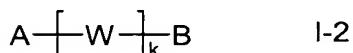


15

wherein R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, X, Y and Z have the meanings given hereinbefore,

20

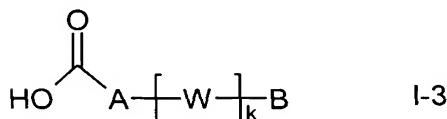
is reacted with CDT (1,1'-carbonyldi-(1,2,4-triazole)) and at least one secondary amine compound of formula I-2



wherein A, B, W and k have the meanings given hereinbefore and the group A has the sec. amine function,

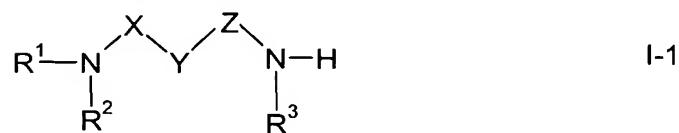
in a solvent or mixture of solvents in the presence of at least one base, and

b) for the other cases at least one carboxylic acid compound of formula I-3



5 wherein A, B, W and k have the meanings given hereinbefore,

is reacted with TBTU (2-(1H-benzotriazol-1-yl)-1,1,3,3-tetramethyluronium-tetrafluoroborate) and at least one amine compound of formula I-1



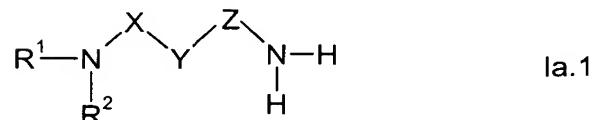
10 wherein R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, X, Y and Z have the meanings given hereinbefore,

in a solvent or mixture of solvents in the presence of at least one base, and

if B is a group R<sup>3</sup> connected to the group A:

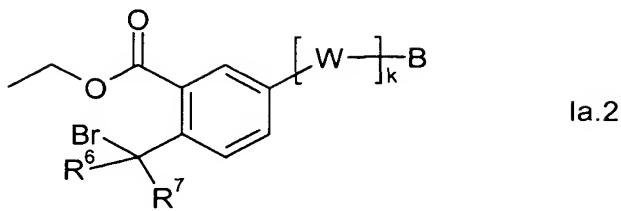
15

a) in the event of a group Q having the meaning -CR<sup>6</sup>R<sup>7</sup>- (IIIa), while R<sup>6</sup> and R<sup>7</sup> are as hereinbefore defined, an amine compound of formula Ia.1



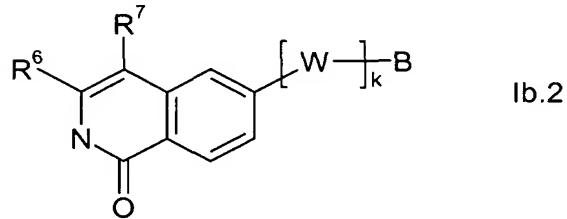
20

wherein R<sup>1</sup>, R<sup>2</sup>, X, Y and Z have the meanings specified, is reacted with an o-bromomethyl-benzoic acid ester derivative of formula Ia.2

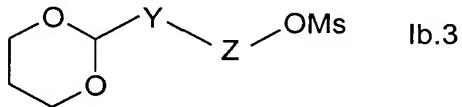


wherein  $R^6$ ,  $R^7$ ,  $W$ ,  $B$  and  $k$  have the meanings specified,

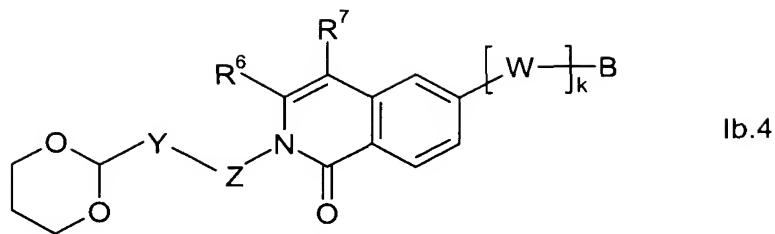
- 5 b) in the event of a group Q having the meaning  $-CR^6=CR^7-$  (IIIb), wherein  $R^6$  and  $R^7$  are as hereinbefore defined, an isoquinolinone derivative of formula Ib.2



- 10 wherein  $R^6$ ,  $R^7$ ,  $W$ ,  $B$  and  $k$  have the meanings specified, is reacted with an electrophilic compound of formula Ib.3

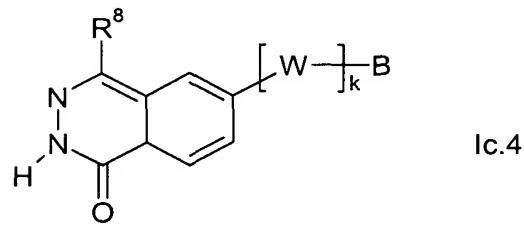


- 15 wherein  $Y$  and  $Z$  have the meanings specified and  $OMs$  denotes a suitable leaving group, preferably mesylate, to obtain an isoquinoline derivative of formula Ib.4



wherein R<sup>6</sup>, R<sup>7</sup>, W, B, Y, Z and k have the meanings specified, and the isoquinoline derivative of formula Ib.4 is further derivatised by known methods to  
5 form the compound of formula I,

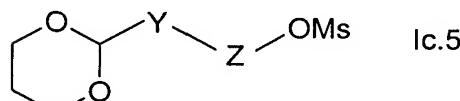
c) in the event of a group Q having the meaning -N=CR<sup>8</sup>- (IIIc), wherein R<sup>8</sup> is as hereinbefore defined, a phthalazinone derivative of formula Ic.4



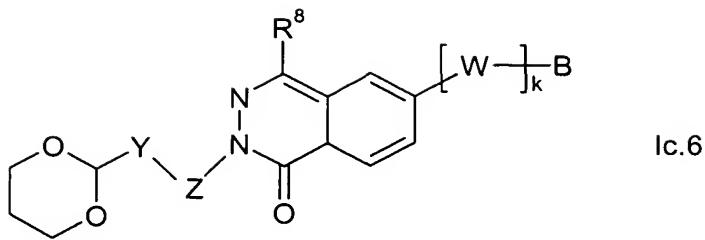
10

wherein R<sup>8</sup>, W, B and k have the meanings specified, is reacted with an electrophilic compound of formula Ic.5

15



wherein Y and Z have the meanings specified and OMs denotes a leaving group, preferably mesylate, to form a phthalazinone derivative of formula Ic.6



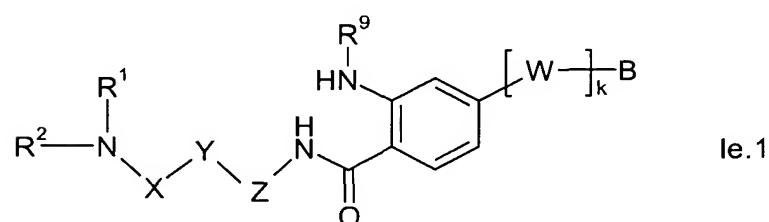
wherein  $R^8$ ,  $W$ ,  $B$ ,  $Y$ ,  $Z$  and  $k$  have the meanings specified, and the phthalazinone derivative of formula Ic.6 thus obtained is further derivatised by known methods to form the compound of formula I wherein  $Q$  denotes  $-N=CR^8-$  (IIlc),

d) in the event of a group  $Q$  having the meaning  $-N=N-$  (IIId) an o-amino-benzamide derivative of formula Id.1



wherein  $R^1$ ,  $R^2$ ,  $W$ ,  $B$ ,  $X$ ,  $Y$ ,  $Z$  and  $k$  have the meanings specified, is reacted in the presence of a suitable nitrite compound and an acid to form the compound of formula I wherein  $Q$  denotes  $-N=N-$ ,

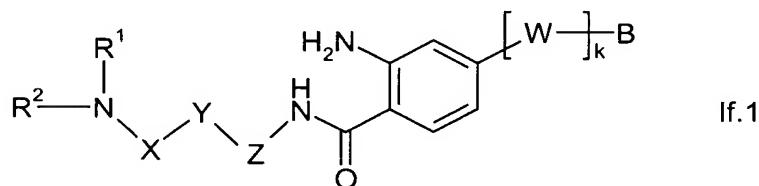
e) in the event of a group  $Q$  having the meaning  $-CO-NR^9-$  (IIIe), wherein  $R^9$  is as hereinbefore defined, an o-amino-benzamide derivative of formula Ie.1



wherein R<sup>1</sup>, R<sup>2</sup>, R<sup>9</sup>, W, B, X, Y, Z and k have the meanings specified, is reacted in the presence of CDI (carbonyldiimidazole) to form the compound of formula I wherein Q denotes -CO-NR<sup>9</sup>-,

5

f) in the event of a group Q having the meaning -CR<sup>8</sup>=N- (IIIf), wherein R<sup>8</sup> is as hereinbefore defined, an o-amino-benzamide derivative of formula If.1

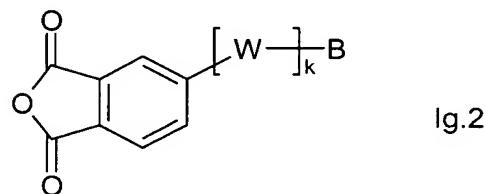


10

wherein R<sup>1</sup>, R<sup>2</sup>, W, B, X, Y, Z and k have the meanings specified, is reacted with a carboxylic acid R<sup>8</sup>COOH having the meaning specified for R<sup>8</sup> and/or a corresponding activated carboxylic acid derivative to the quinazolinone derivative of formula I wherein Q denotes -CR<sup>8</sup>=N-,

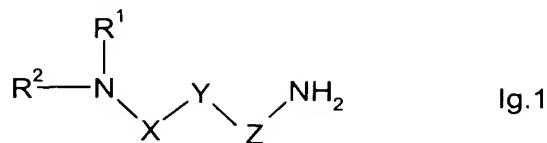
15

g) in the event of a group Q having the meaning -CO- (IIlg) an isobenzofurandione derivative of formula Ig.2



20

wherein W, B and k have the meanings specified, is reacted with an amine of formula Ig.1



wherein R<sup>1</sup>, R<sup>2</sup>, X, Y and Z have the meanings specified, to form the compound of formula I wherein Q denotes -CO-.

5

This invention also includes the physiologically acceptable salts of the carboxamide compounds according to the invention as described above and hereinafter.

10 Also covered by this invention are compositions containing at least one according to the invention carboxamide compound and/ or a salt according to the invention optionally together with one or more physiologically acceptable excipients.

15 Also covered by this invention are pharmaceutical compositions containing at least one carboxamide compound according to the invention and/ or a salt according to the invention optionally together with one or more inert carriers and/or diluents.

20 The invention also relates to the use of at least one carboxamide compound according to the invention and/ or a salt according to the invention for influencing the eating behaviour of a mammal.

The invention also relates to the use of at least one carboxamide compound according to the invention and/ or a salt according to the invention for reducing the body weight and/or for preventing an increase in the body weight of a mammal.

25

The invention also relates to the use of at least one carboxamide compound according to the invention and/ or a salt according to the invention for preparing a pharmaceutical composition with an MCH-receptor-antagonistic activity.

Moreover, the invention relates to the use of at least one carboxamide compound according to the invention and/ or a salt according to the invention for preparing a pharmaceutical composition which is suitable for the prevention and/or treatment  
5 of symptoms and/or diseases which are caused by MCH or are otherwise causally connected with MCH.

The invention also relates to the use of at least one carboxamide compound according to the invention and/ or a salt according to the invention for preparing a  
10 pharmaceutical composition which is suitable for the prevention and/or treatment of metabolic disorders and/or eating disorders, particularly obesity, bulimia, bulimia nervosa, cachexia, anorexia, anorexia nervosa and hyperphagia.

This invention also relates to the use of at least one carboxamide compound  
15 according to the invention and/ or a salt according to the invention for preparing a pharmaceutical composition which is suitable for the prevention and/or treatment of diseases and/or disorders associated with obesity, particularly diabetes, especially type II diabetes, complications of diabetes including diabetic retinopathy, diabetic neuropathy, diabetic nephropathy, insulin resistance,  
20 pathological glucose tolerance, encephalorrhagia, cardiac insufficiency, cardiovascular diseases, particularly arteriosclerosis and high blood pressure, arthritis and gonitis.

Moreover, the invention relates to the use of at least one carboxamide compound  
25 according to the invention and/ or a salt according to the invention for preparing a pharmaceutical composition which is suitable for the prevention and/or treatment of hyperlipidaemia, cellulitis, fat accumulation, malignant mastocytosis, systemic mastocytosis, emotional disorders, affective disorders, depression, anxiety, sleep disorders, reproductive disorders, sexual disorders, memory disorders, epilepsy,  
30 forms of dementia and hormonal disorders.

Another object of the invention is the use of at least one carboxamide compound according to the invention and/ or a salt according to the invention for preparing a pharmaceutical composition which is suitable for the prevention and/or treatment of micturition disorders, such as for example urinary incontinence, hyperactive  
5 urinary bladder, urgency, nocturia and enuresis.

Furthermore the invention relates to processes for preparing a pharmaceutical composition according to the invention, characterised in that at least one  
10 carboxamide compound according to the invention and/ or a salt according to the invention is incorporated in one or more inert carriers and/or diluents by a non-chemical method.

The invention further relates to a pharmaceutical composition containing a first  
15 active substance selected from the carboxamide compounds according to the invention and/ or the corresponding salts, as well as a second active substance selected from the group consisting of active substances for the treatment of diabetes, active substances for the treatment of diabetic complications, active substances for the treatment of obesity, preferably other than MCH antagonists,  
20 active substances for the treatment of high blood pressure, active substances for the treatment of hyperlipidaemia, including arteriosclerosis, active substances for the treatment of arthritis, active substances for the treatment of anxiety states and active substances for the treatment of depression, optionally together with one or more inert carriers and/or diluents.

25

#### **Detailed description of the invention**

Unless otherwise specified the groups, residues, substituents and indices, particularly A, B, W, X, Y, Z, R<sup>1</sup> to R<sup>9</sup>, R<sup>11</sup> to R<sup>22</sup>, L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> and k, have one of the  
30 meanings given above or hereinafter.

A preferred embodiment of this invention comprises compounds of formula I wherein

R<sup>3</sup> denotes H, C<sub>1-6</sub>-alkyl, C<sub>3-7</sub>-cycloalkyl, C<sub>3-7</sub>-cycloalkyl-C<sub>1-4</sub>-alkyl-, C<sub>1-3</sub>-alkoxy-C<sub>2-6</sub>-alkyl-, amino-C<sub>2-6</sub>-alkyl-, C<sub>1-3</sub>-alkyl-amino-C<sub>2-6</sub>-alkyl- or di-(C<sub>1-3</sub>-alkyl)-amino-C<sub>2-6</sub>-alkyl-,

B has one of the meanings given for Cy, while the bond to the group W or optionally directly to the group A is formed via a C atom of the carbocyclic moiety or of the optionally fused-on phenyl or pyridine ring or via an N or C atom of the heterocyclic moiety.

while if  $k=0$  the group B and the group A may be connected to one another via a common C atom forming a spirocyclic ring system or via two common, adjacent atoms forming a fused, bicyclic ring system,

20 Cy denotes a carbo- or heterocyclic group selected from one of the following meanings

- a saturated 3- to 7-membered carbocyclic group,
- an unsaturated 5- to 7-membered carbocyclic group,
- a phenyl group,
- a saturated 4- to 7-membered or unsaturated 5- to 7-membered heterocyclic group with an N, O or S atom as heteroatom,
- a saturated or unsaturated 5- to 7-membered heterocyclic group with two or more N atoms or with one or two N atoms and an O or S atom as heteroatoms,
- an aromatic heterocyclic 5- or 6-membered group with one or more identical or different heteroatoms selected from N, O and/or S.

25

30

while the above mentioned 5-, 6- or 7-membered groups may be connected via two common, adjacent C atoms fused with a phenyl or pyridine ring, and

5 in the above mentioned 5-, 6- or 7-membered groups a -CH<sub>2</sub>-group may be replaced by a -CO-, -C(=CH<sub>2</sub>)-, -(SO)- or -(SO<sub>2</sub>)- group, and

10 the above mentioned saturated 6- or 7-membered groups may also occur as bridged ring systems with an imino, N-(C<sub>1-3</sub>-alkyl)-imino-, methylene-, C<sub>1-3</sub>-alkyl-methylene- or di-(C<sub>1-3</sub>-alkyl)-methylene-bridge, and

15 the above mentioned cyclic groups may be mono- or polysubstituted at one or more C atoms with R<sup>20</sup>, or in the case of a phenyl group may also additionally be monosubstituted by nitro, and/or may be substituted at one or more N atoms with R<sup>21</sup>,

20 R<sup>15</sup> denotes H, C<sub>1-4</sub>-alkyl, C<sub>3-7</sub>-cycloalkyl, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkyl-, phenyl or phenyl-C<sub>1-3</sub>-alkyl-,

25 R<sup>17</sup> has one of the meanings given for R<sup>16</sup> or denotes phenyl, phenyl-C<sub>1-3</sub>-alkyl-, dioxolan-2-yl, C<sub>1-3</sub>-alkylcarbonyl-, hydroxycarbonyl-C<sub>1-3</sub>-alkyl-, C<sub>1-3</sub>-alkylcarbonylamino-C<sub>2-3</sub>-alkyl-, C<sub>1-3</sub>-alkylsulphonyl- or C<sub>1-3</sub>-alkylsulphonylamino-C<sub>2-3</sub>-alkyl-,

30 R<sup>22</sup> denotes phenyl, phenyl-C<sub>1-3</sub>-alkoxy-, C<sub>1-3</sub>-alkoxy, C<sub>1-3</sub>-alkylthio, carbonyl, C<sub>1-3</sub>-alkylcarbonyl, C<sub>1-3</sub>-alkoxycarbonyl, aminocarbonyl, C<sub>1-3</sub>-alkylaminocarbonyl, di-(C<sub>1-3</sub>-alkyl)-aminocarbonyl, C<sub>1-3</sub>-alkylsulphonyl, C<sub>1-3</sub>-alkyl-sulphanyl, C<sub>1-3</sub>-alkyl-sulphonylamino, amino, C<sub>1-3</sub>-alkylamino-, di-(C<sub>1-3</sub>-alkyl)-amino-, phenyl-C<sub>1-3</sub>-alkylamino- or N-(C<sub>1-3</sub>-alkyl)-phenyl-C<sub>1-3</sub>-alkylamino-, acetylamino-, propionylamino-,

phenylcarbonyl, phenylcarbonylamino-, phenylcarbonylmethylamino-, hydroxyalkylaminocarbonyl, (4-morpholinyl)carbonyl, (1-pyrrolidinyl)- carbonyl, (1-piperidinyl)carbonyl, (hexahydro-1-azepinyl)carbonyl, (4- methyl-1-piperazinyl)carbonyl, methylenedioxy, aminocarbonyl- amino- or alkylaminocarbonylamino-

while in the groups and residues A, B, W, X, Y, Z, R<sup>1</sup> to R<sup>9</sup> and R<sup>11</sup> to R<sup>22</sup> in each case one or more C atoms may be mono- or polysubstituted by F and/or in each case one or two C atoms may be monosubstituted by Cl or Br independently of one another and

the H atom of any carboxy group present or an H atom bound to an N atom may be replaced in each case by a group which can be cleaved *in vivo*.

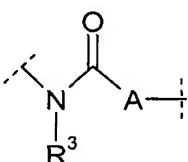
15 the tautomers, diastereomers, enantiomers, mixtures thereof and the salts thereof.

According to the first group of the preferred embodiments the group A and the group R<sup>3</sup> are not directly connected to one another. Therefore the group A has one of the meanings given for Cy.

20

According to the second group of the preferred embodiments the group A and the group R<sup>3</sup> are connected to one another in such a way that

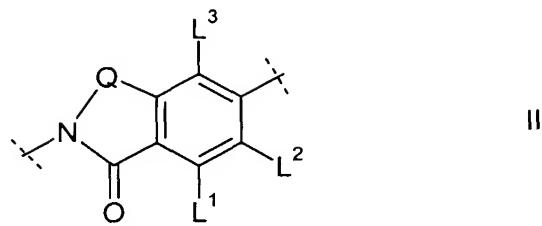
## the group



of formula I

denotes a group of partial formula II

25



and

5    Q       denotes a group selected from the partial formulae IIIa to IIIg

|                                     |       |
|-------------------------------------|-------|
| —CR <sup>6</sup> R <sup>7</sup> —   | IIIa, |
| —CR <sup>6</sup> =CR <sup>7</sup> — | IIIb, |
| —N=CR <sup>8</sup> —                | IIIc, |
| —N=N—                               | IIId, |
| —CO—NR <sup>9</sup> —               | IIIe, |
| —CR <sup>8</sup> =N—                | IIIf, |
| —CO—                                | IIIg. |

Preferred meanings for the group Q are selected from the partial formulae IIIb, IIId, IIIe, IIIf and IIIg, particularly IIId, IIIe, IIIf and IIIg.

10

Preferred meanings for the substituents R<sup>6</sup>, R<sup>7</sup>, R<sup>8</sup> and R<sup>9</sup> are independently of one another H and C<sub>1-4</sub>-alkyl, particularly H, methyl or ethyl.

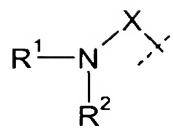
15

Preferably the substituents L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> independently of one another have one of the following meanings H, F, Cl, Br, CH<sub>3</sub>, CHF<sub>2</sub>, CF<sub>3</sub>, C<sub>2</sub>H<sub>5</sub>, C<sub>3</sub>H<sub>7</sub>, CH(CH<sub>3</sub>)<sub>2</sub>, OCH<sub>3</sub>, OCHF<sub>2</sub>, OCF<sub>3</sub>, OC<sub>2</sub>H<sub>5</sub>, OC<sub>3</sub>H<sub>7</sub> and OCH(CH<sub>3</sub>)<sub>2</sub>.

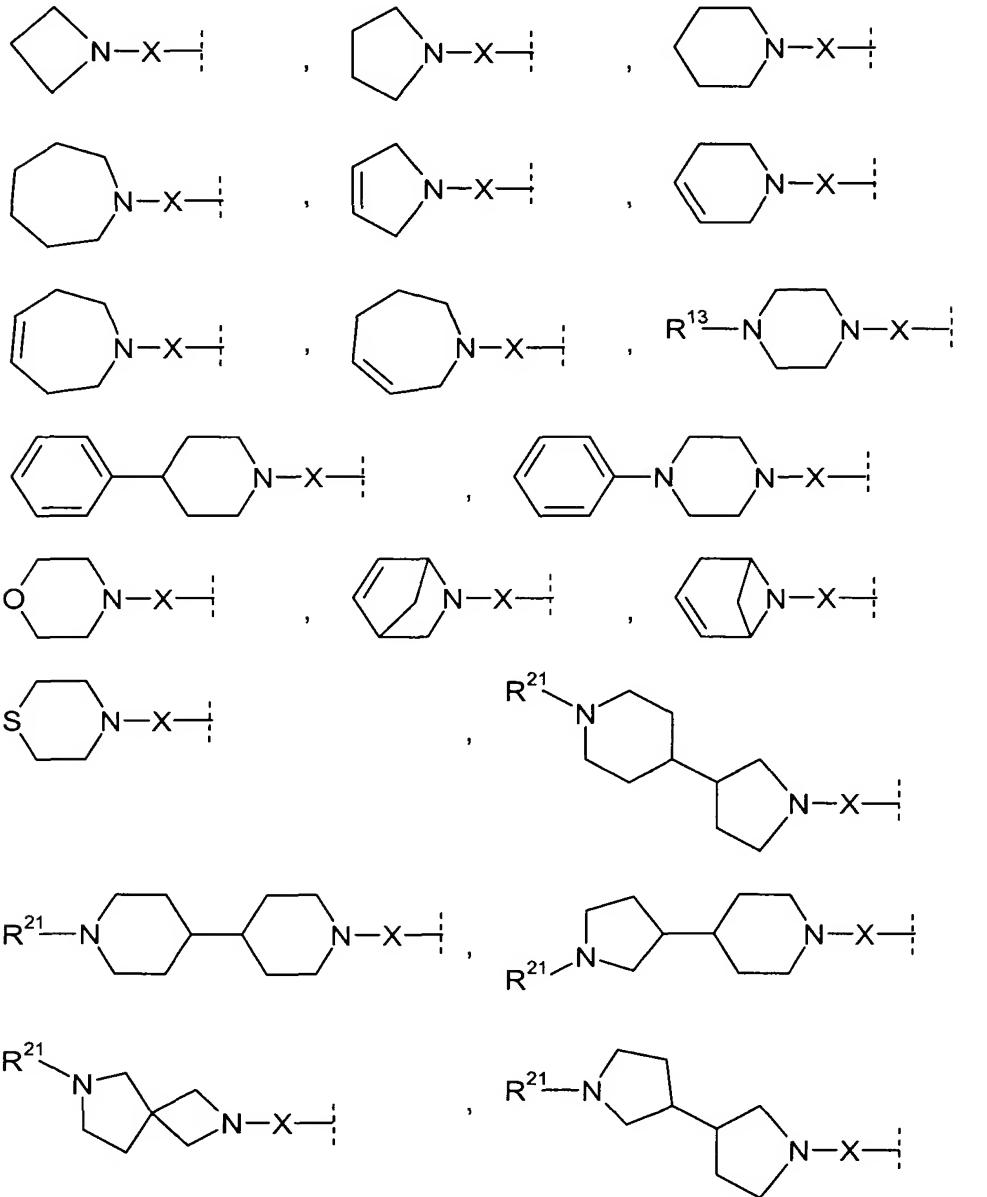
Preferably only one of the substituents L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> has a meaning other than H, particularly one of the meanings mentioned above as being preferred. Particularly preferably all three substituents L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> represent H.

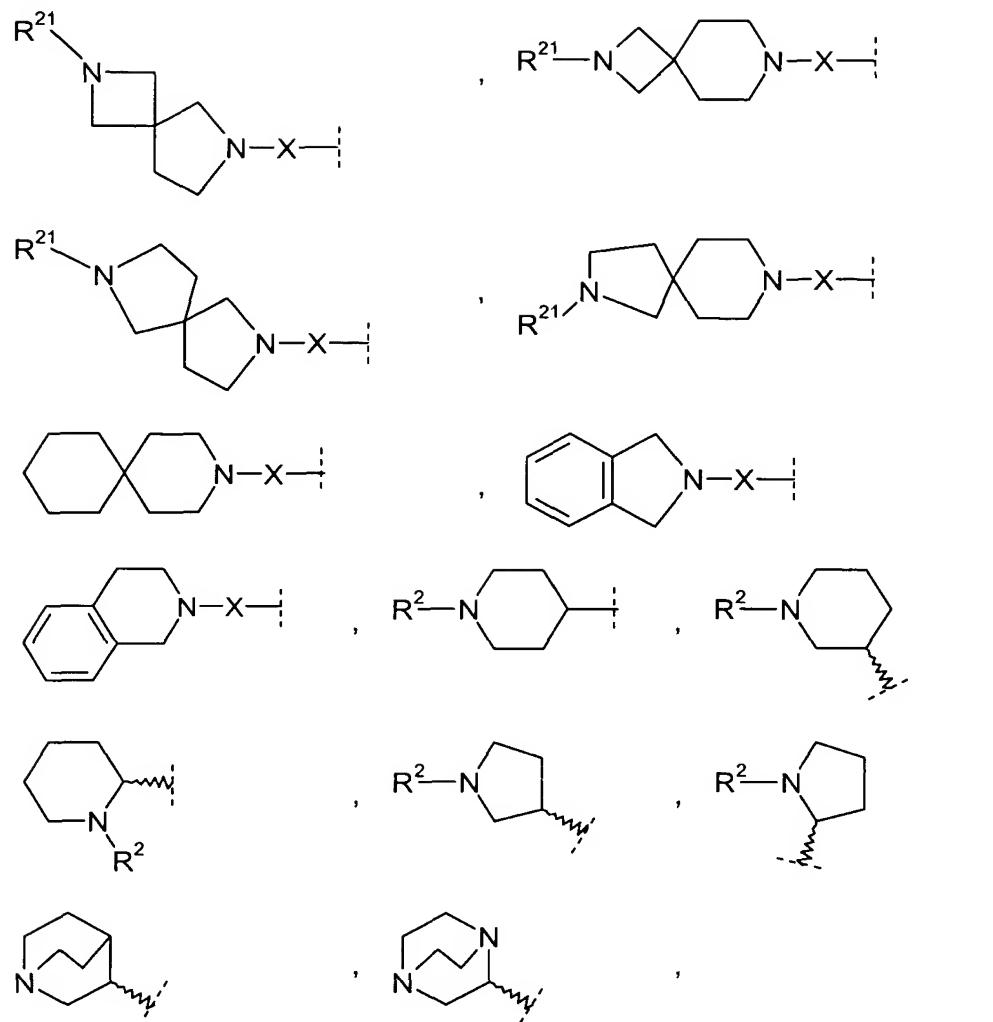
- 5 Preferably the groups R<sup>1</sup>, R<sup>2</sup> independently of one another denote H, C<sub>1-6</sub>-alkyl, C<sub>3-7</sub>-cycloalkyl, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkyl-, ω-hydroxy-C<sub>2-3</sub>-alkyl-, ω-(C<sub>1-3</sub>-alkoxy)-C<sub>2-3</sub>-alkyl-, C<sub>1-4</sub>-alkoxy-carbonyl-C<sub>1-3</sub>-alkyl-, amino-C<sub>2-4</sub>-alkyl-, C<sub>1-3</sub>-alkyl-amino-C<sub>2-4</sub>-alkyl- or di-(C<sub>1-3</sub>-alkyl)-amino-C<sub>2-4</sub>-alkyl-, phenyl or phenyl-C<sub>1-3</sub>-alkyl-, while in the above mentioned groups and residues one or more C atoms may be mono- or
- 10 polysubstituted by F and/or one or two C atoms independently of one another may be monosubstituted by Cl or Br, and the phenyl group may be mono- or polysubstituted by the above defined group R<sup>12</sup> and/or may be monosubstituted by nitro.
- 15 Most preferably the groups R<sup>1</sup>, R<sup>2</sup> independently of one another denote C<sub>1-4</sub>-alkyl, C<sub>3-7</sub>-cycloalkyl, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkyl-, ω-hydroxy-C<sub>2-3</sub>-alkyl-, ω-(C<sub>1-3</sub>-alkoxy)-C<sub>2-3</sub>-alkyl-, C<sub>1-4</sub>-alkoxy-carbonyl-C<sub>1-3</sub>-alkyl-, while one of the groups R<sup>1</sup>, R<sup>2</sup> may also denote H.
- 20 Preferably, also, R<sup>1</sup> and R<sup>2</sup> form an alkylene bridge in such a way that R<sup>1</sup>R<sup>2</sup>N- denotes a group selected from azetidine, pyrrolidine, piperidine, azepan, 2,5-dihydro-1H-pyrrole, 1,2,3,6-tetrahydro-pyridine, 2,3,4,7-tetrahydro-1H-azepinyl, 2,3,6,7-tetrahydro-1H-azepine, piperazine, wherein the free imine function may be substituted by R<sup>13</sup>, morpholine and thiomorpholine, while according to the general
- 25 definition of R<sup>1</sup> and R<sup>2</sup> one or more H atoms may be replaced by R<sup>14</sup>, and/ or the above mentioned groups may be substituted by one or two identical or different carbo- or heterocyclic groups Cy in a manner specified according to the general definition of R<sup>1</sup> and R<sup>2</sup>.

Particularly preferably, the group



is defined according to one of the following partial formulae



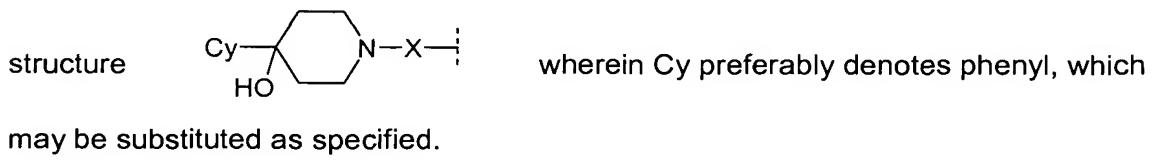


wherein one or more H atoms of the heterocycle formed by the group  $R^1R^2N$ - may be replaced by  $R^{14}$  and the ring connected to the heterocycle formed by the group  $R^1R^2N$ - may be mono- or polysubstituted at one or more C atoms by  $R^{20}$ , and in  
5 the case of a phenyl ring may also additionally be monosubstituted by nitro.

Most particularly preferred are the groups  $R^1R^2N$  described above, wherein  $R^1$  and  $R^2$  form with the N atom of the group  $R^1R^2N$ - a pyrrolidine, piperidine or 2,5-dihydro-1H-pyrrole ring, which may be substituted as specified.

- Preferred meanings for the group  $R^{14}$  are  $C_{1-4}$ -alkyl,  $C_{1-4}$ -cycloalkyl, hydroxy,  $C_{1-4}$ -alkoxy,  $C_{1-4}$ -alkoxy- $C_{1-3}$ -alkyl-, hydroxy- $C_{1-3}$ -alkyl,  $C_{1-4}$ -alkyl-carbonyl,  $C_{1-4}$ -alkoxy-carbonyl,  $C_{1-4}$ -alkoxy-carbonyl- $C_{1-3}$ -alkyl-,  $C_{1-4}$ -alkoxy-carbonylamino-,  $C_{1-4}$ -alkoxy-carbonylamino- $C_{1-3}$ -alkyl-, amino, ( $C_{1-4}$ -alkyl)-amino-, di-( $C_{1-4}$ -alkyl)-amino-, phenyl, phenoxy, pyridinyl and pyridinyloxy.
- 5      carbonylamino- $C_{1-3}$ -alkyl-, amino, ( $C_{1-4}$ -alkyl)-amino-, di-( $C_{1-4}$ -alkyl)-amino-, phenyl, phenoxy, pyridinyl and pyridinyloxy.

A preferred piperidine group substituted by the group Cy has the



- 10      Preferably the alkylene bridge X has no, or at most one,  $-NR^4-$  group. The position of the  $NR^4$  group within the alkylene bridge X is preferably selected so that together with the amino group  $NR^1R^2$  or another adjacent amino group no aminal function is formed or two N atoms are adjacent to one another. Therefore, in the
- 15      event that a  $-CH_2$ -group is replaced by  $-NR^4-$ , the alkylene bridge preferably denotes  $C_{2-7}$ -alkylene- $NR^4-C_{0-5}$ -alkylene, while the bridge X has a maximum of 7 bridging C atoms in addition to the N atom and the C atoms may be substituted in the specified manner.
- 20      Preferably X denotes a single bond or an unbranched bridge selected from  $C_{1-6}$ -alkylene,  $C_{2-6}$ -alkenylene,  $C_{2-6}$ -alkynylene,  $C_{1-6}$ -alkylenoxy, carbonyl, carbonyl- $C_{1-6}$ -alkylene or  $C_{1-6}$ -alkylene-amino-, wherein the amino group may be substituted by  $R^4$ , while one or two C atoms may be substituted in the manner specified in the general definition of X and/or the alkylene bridge may be
- 25      connected to  $R^1$  in the manner specified.

Particularly preferably, X denotes a single bond, carbonyl or an alkylene bridge selected from methylene, 1,2-ethylene, 1,3-propylene and 1,4-butylene, wherein

one or two C atoms may be substituted independently of one another with a hydroxy,  $\omega$ -hydroxy-C<sub>1-3</sub>-alkyl,  $\omega$ -(C<sub>1-3</sub>-alkoxy)-C<sub>1-3</sub>-alkyl- and/or C<sub>1-3</sub>-alkoxy group and/or in each case with one or two identical or different C<sub>1-4</sub>-alkyl groups, and in each case one or more C atoms may be mono- or polysubstituted by F and/or in

- 5 each case one or two C atoms may be monosubstituted by Cl or Br independently of one another.

If in group X one or two C atoms are substituted by a hydroxy and/or C<sub>1-3</sub>-alkoxy group, the substituted C atom is preferably not directly adjacent to an amino

- 10 group, particularly -NR<sup>1</sup>R<sup>2</sup> or -NR<sup>4</sup>-.

Most preferably, the bridge X is a single bond, -CH<sub>2</sub>- or -CH(CH<sub>3</sub>)-.

In the event that a -CH<sub>2</sub>-group is replaced by -NR<sup>5</sup>- in the bridge Z, the position of

- 15 the NR<sup>5</sup> group within the group Z is preferably selected so that together with the amino group -NR<sup>3</sup>- or another adjacent amino group no aminal function is formed or two N atoms are adjacent to one another.

Preferred meanings of the bridge Z are methylene, 1,2-ethylene, 1,3-propylene,

- 20 1,4-butylene, methyleneoxy, 1,2-ethylenoxy, 1,3-propyleneoxy and 1,4-butylenoxy, wherein one or two C atoms may be substituted independently of one another by a hydroxy,  $\omega$ -hydroxy-C<sub>1-3</sub>-alkyl,  $\omega$ -(C<sub>1-3</sub>-alkoxy)-C<sub>1-3</sub>-alkyl- and/or C<sub>1-3</sub>-alkoxy group and/or in each case by one or two identical or different C<sub>1-4</sub>-alkyl groups, and in each case one or more C atoms may be mono- or polysubstituted 25 by F and/or in each case one or two C atoms independently of one another may be monosubstituted by Cl or Br and R<sup>3</sup> may be connected to Z so as to include the N atoms connected to R<sup>3</sup>, forming a heterocyclic group.

If in the group Z one or two C atoms are substituted by a hydroxy and/or C<sub>1-3</sub>-

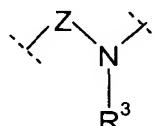
- 30 alkoxy group, the substituted C atom is preferably not directly adjacent to an amino group, particularly -NR<sup>3</sup>- or -NR<sup>5</sup>-.

Particularly preferably, Z is selected from the group -CH<sub>2</sub>-, -CH<sub>2</sub>-CH<sub>2</sub>-, -CH<sub>2</sub>-CH(CH<sub>3</sub>)-, -CH<sub>2</sub>-C(CH<sub>3</sub>)<sub>2</sub>-, -CH(CH<sub>3</sub>)-CH<sub>2</sub>-, -C(CH<sub>3</sub>)<sub>2</sub>-CH<sub>2</sub>- and -CH<sub>2</sub>-O-, particularly -CH<sub>2</sub>-CH<sub>2</sub>- or -CH(CH<sub>3</sub>)-CH<sub>2</sub>-.

5

Moreover according to a particularly preferred definition Z is connected to R<sup>3</sup> so that

the group of partial formula



has a meaning

selected from 1,3-pyrrolidinylene, 1,3-piperidinylene, 1,2,5,6-tetrahydropyridin-1,3-ylene and 3-hydroxy-1,3-piperidinylene.

Preferably the group R<sup>3</sup> is selected from among methyl, ethyl, n-propyl, iso-propyl, 2-hydroxyethyl, 3-hydroxy-n-propyl or 2-hydroxy-1-methyl-ethyl, while in the groups specified one, two or three H atoms may be replaced by F, or R<sup>3</sup> is  
15 selected from the group H, amino-C<sub>2-3</sub>-alkyl-, C<sub>1-3</sub>-alkyl-amino-C<sub>2-3</sub>-alkyl- or di-(C<sub>1-3</sub>-alkyl)-amino-C<sub>2-3</sub>-alkyl-.

Particularly preferred meanings of the group R<sup>3</sup> are H, methyl or ethyl, particularly H or methyl.

20

Preferred meanings of the groups R<sup>4</sup> and/or R<sup>5</sup> are H, C<sub>1-4</sub>-alkyl, C<sub>3-6</sub>-cycloalkyl and C<sub>3-6</sub>-cycloalkyl-C<sub>1-3</sub>-alkyl-, particularly H and C<sub>1-4</sub>-alkyl.

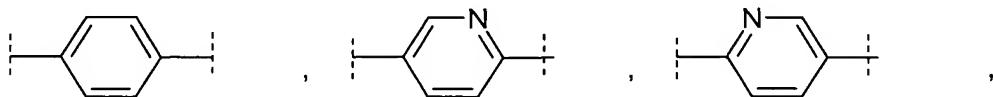
Preferred meanings of the group R<sup>11</sup> are C<sub>1-6</sub>-cycloalkyl, hydroxy, C<sub>1-4</sub>-alkoxy, 25 amino, C<sub>1-4</sub>-alkyl-amino- and di-(C<sub>1-4</sub>-alkyl)-amino-.

Preferred meanings of the group R<sup>20</sup> are halogen, hydroxy, cyano, C<sub>1-4</sub>-alkyl, C<sub>3-7</sub>-cycloalkyl and hydroxy-C<sub>1-3</sub>-alkyl. Particularly preferably R<sup>20</sup> denotes F, Cl, Br, I,

OH, cyano, methyl, difluoromethyl, trifluoromethyl, ethyl, n-propyl, iso-propyl, methoxy, difluoromethoxy, trifluoromethoxy, ethoxy, n-propoxy or iso-propoxy.

- The group Y is preferably selected from among the bivalent cyclic groups 1,2-
- 5    cyclopropylene, 1,3-cyclobutylene, 1,3-cyclopentylene, 1,3-cyclopentenylene, 1,3- and 1,4-cyclohexylene, 1,3-phenylene, 1,4-phenylene, 1,3- and 1,4-  
cyclohexenylene, 1,4-cycloheptylene, 1,4-cycloheptenylene, 1,3-pyrrolidinylene,  
1,3-pyrrolinylene, 1,3-pyrrolylene, 1,4-piperidinylene, 1,4-tetrahydropyridinylene,  
1,4-dihydropyridinylene, 2,4- and 2,5-pyridinylene or 1,4-piperazinylene, while the  
10   above mentioned 5-, 6- or 7-membered groups may be connected via two  
common, adjacent C atoms fused with a phenyl or pyridine ring, the above  
mentioned cyclic groups may be mono- or polysubstituted at one or more C atoms  
by R<sup>20</sup>, in the case of a phenyl group they may also additionally be  
monosubstituted by nitro, and/or may be substituted at one or more N atoms with  
15   R<sup>21</sup>, and R<sup>1</sup> may be connected to Y and/or R<sup>3</sup> may be connected to Y in the  
manner specified in the general definition.

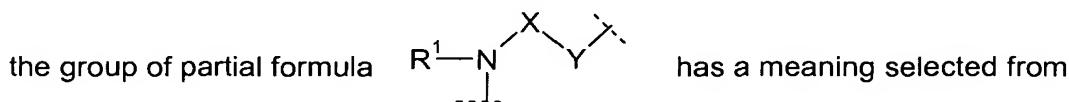
Most particularly preferred meanings of the group Y are selected from the group of cyclic structures consisting of:



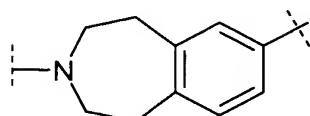
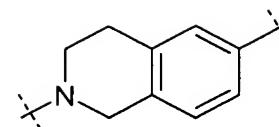
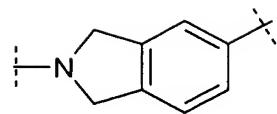
20

while the cyclic groups may be mono- or disubstituted, preferably monosubstituted, by R<sup>20</sup>, preferably by halogen, CF<sub>3</sub>, C<sub>1-4</sub>-alkyl and/or C<sub>1-4</sub>-alkoxy.

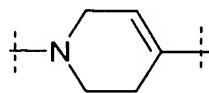
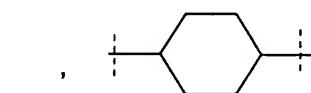
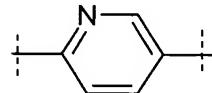
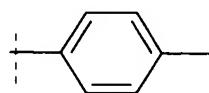
In addition, the group Y may also be linked to the group R<sup>1</sup> in such a way that



the following partial formulae



- Preferred meanings for the group A are selected from among the bivalent cyclic groups 1,2-cyclopropylene, 1,3-cyclobutylene, 1,3-cyclopentylene, 1,3-cyclopentenylene, 1,3- and 1,4-cyclohexylene, 1,3- and 1,4-phenylene, 1,3- and 1,4-  
5 cyclohexenylene, 1,4-cycloheptylene, 1,4-cycloheptenylene, 1,3-pyrrolidinylene,  
1,3-pyrrolinylene, 1,3-pyrrolylene, 1,4-piperidinylene, 1,4-tetrahydropyridinylene,  
1,4-dihydropyridinylene, 2,4- and 2,5-pyridinylene, 1,4-piperazinylene, 7-aza-  
bicyclo[2.2.1]heptan-2,7-diyl and 8-aza-bicyclo[3.2.1]octan-3,8-diyl, while the  
above mentioned 5-, 6- or 7-membered groups may be connected via two  
10 common, adjacent C atoms fused with a phenyl or pyridine ring, and the above  
mentioned cyclic groups may be mono- or polysubstituted at one or more C atoms  
with R<sup>20</sup>, in the case of a phenyl group they may also additionally be  
monosubstituted by nitro, and/or substituted by R<sup>21</sup> at one or more N atoms.  
  
15 Most particularly preferred meanings for the group A are selected from the group  
of cyclic structures consisting of:



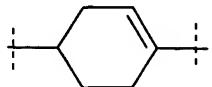
while the cyclic groups may be mono- or disubstituted, preferably  
monosubstituted, by R<sup>20</sup>, preferably by halogen, CF<sub>3</sub>, C<sub>1-4</sub>-alkyl and/or C<sub>1-4</sub>-alkoxy.

The bivalent cyclic groups specified for Y and/or A in each case include the mirror-symmetrical forms, i.e. the forms in which the link to the adjacent groups, to X and Z in the case of Y and also to CO and W in the case of A, is swapped over. Thus,

- 5 for example, 1,4-cyclohexenylene denotes both



and



The bivalent cyclic groups given above for the groups Y and A include all the possible isomers. Some meanings mentioned above as being preferred will be explained more fully hereinafter:

10

The definition tetrahydropyridinylene comprises the meanings 1,2,3,4-tetrahydropyridin-1,4- and -3,6-ylene, 1,2,3,6-tetrahydropyridin-1,4-, -2,5- and -3,6-ylene, 2,3,4,5-tetrahydropyridin-2,5- and -3,6-ylene. The preferred meaning is 1,2,3,6-tetrahydropyridin-1,4-ylene.

15

The definition dihydropyridinylene comprises the meanings 1,4- and 1,2-dihydropyridin-1,4-ylene as well as 1,2-, 1,4-, 1,6-, 2,3-, 2,5-, 3,4-, 4,5- and 5,6-dihydropyridin-2,5-ylene. The preferred meaning is 1,2-dihydropyridin-1,4-ylene.

20

Preferably the groups A and/or B are unsubstituted or mono- or disubstituted by R<sup>20</sup>, most preferably unsubstituted or monosubstituted by R<sup>20</sup>.

25

Preferred meanings for the group B according to a first embodiment are selected from the group C<sub>1-6</sub>-alkyl, C<sub>1-6</sub>-alkenyl, C<sub>1-6</sub>-alkynyl, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkyl-, C<sub>3-7</sub>-cycloalkenyl-C<sub>1-3</sub>-alkyl-, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkenyl- or C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkynyl-, wherein one or more C atoms may be mono- or polysubstituted by halogen and/or monosubstituted by hydroxy or cyano and/or cyclic groups may be mono- or polysubstituted by R<sup>20</sup>, and

- W denotes a single bond, -O-, a C<sub>1-4</sub>-alkylene, C<sub>2-4</sub>-alkenylene, C<sub>2-4</sub>-alkynylene, C<sub>1-4</sub>-alkyleneoxy, Oxy-C<sub>1-4</sub>-alkylene, C<sub>1-3</sub>-alkylene-oxy-C<sub>1-3</sub>-alkylene, imino, N-(C<sub>1-3</sub>-alkyl)-imino-, imino-C<sub>1-4</sub>-alkylene-, N-(C<sub>1-3</sub>-alkyl)-imino-C<sub>1-4</sub>-alkylene-, C<sub>1-4</sub>-alkylene-imino- or C<sub>1-4</sub>-alkylene-N-(C<sub>1-3</sub>-alkyl)-imino- group, while one or two C atoms independently of one another may be substituted by a hydroxy, ω-hydroxy-C<sub>1-3</sub>-alkyl, ω-(C<sub>1-3</sub>-alkoxy)-C<sub>1-3</sub>-alkyl and/or C<sub>1-3</sub>-alkoxy group and/or with one or two identical or different C<sub>1-4</sub>-alkyl groups, and
- 10 k denotes 0 or 1, particularly 1 and
- R<sup>20</sup> has one of the meanings given hereinbefore.
- In the above mentioned preferred meanings for B, k preferably has the value 1 and W preferably denotes a single bond, imino or N-(C<sub>1-3</sub>-alkyl)-imino, particularly a single bond.
- Particularly preferably, the group B denotes C<sub>3-6</sub>-alkynyl, particularly C<sub>3-6</sub>-alk-1-ynyl, and/or the group W denotes a single bond, while k = 1.
- 20 Preferred meanings for the group B according to a second embodiment are selected from among the cyclic groups cyclopropyl, cyclobutyl, cyclopentyl, cyclopentenyl, cyclohexyl, cyclohexanonyl, cyclohexenyl, phenyl, cycloheptyl, cycloheptenyl, aziridinyl, azetidinyl, pyrrolidinyl, pyrrolinyl, pyrrolyl, piperidinyl, tetrahydropyridinyl, dihydropyridinyl, pyridinyl, azepanyl, piperazinyl, 1H-pyrazolyl, imidazolyl, triazolyl, tetrazolyl, morpholinyl, thiomorpholinyl, indolyl, isoindolyl, quinolinyl, benzoimidazolyl, isoquinolinyl, furanyl and thienyl, while the bond to the group W or optionally directly to the group A is formed via a C atom of the carbocyclic moiety or of the optionally fused-on phenyl or pyridine ring or via an N or C atom of the heterocyclic moiety, or B together with the group W connected via a double bond is selected from the group cyclopentylidene-methyl,

cyclohexylidene-methyl and cyclohexanon-4-ylidene-methyl, and the above mentioned cyclic groups may be mono- or polysubstituted at one or more C atoms with R<sup>20</sup>, in the case of a phenyl group they may also additionally be monosubstituted by nitro, and/or may be substituted at one or more N atoms 5 with R<sup>21</sup>.

Most particularly preferably the group B denotes phenyl, which is mono-, di- or trisubstituted, preferably mono- or disubstituted by R<sup>20</sup>.

- 10 The definitions of B given above include all the possible isomers for the groups in question. Thus, in particular, the following isomers are included: cyclopenten-1-, 3- and 4-yl, cyclohexanon-4-yl, cyclohexen-1-, 3- and 4-yl, cyclohepten-1-, 3-, 4- and 5-yl, aziridin-1-yl, azetidin-1-yl, pyrrolidin-1-yl, pyrrolin-1-yl, pyrrol-1-yl, piperidin-1- and 4-yl, pyridin-2-, -3- and -4-yl, azepan-1-yl, piperazin-1-yl, 4-methyl-piperazin-1-yl, morpholin-4-yl, thiomorpholin-4-yl, quinolin-2-, 3-, 4-, 5-, 6-, 7- and 8-yl, 15 isoquinolin-1-, 3-, 4-, 5-, 6-, 7- and 8-yl, 1H-benzimidazol-1-, 2-, 4-, 5-, 6- and 7-yl.

The definition pyrazole comprises the isomers 1H-, 3H- and 4H-pyrazole.

- 20 Preferably pyrazolyl denotes 1H-pyrazol-1-yl.

The definition imidazole comprises the isomers 1H-, 2H- and 4H-imidazole. A preferred meaning of imidazolyl is 1H-imidazol-1-yl.

- 25 The definition tetrahydropyridine comprises the isomers 1,2,3,4-, 1,2,3,6- and 2,3,4,5-tetrahydropyridin. Preferably tetrahydropyridinyl denotes 1,2,3,4- and 1,2,3,6-tetrahydropyridin-1-yl.

- 30 The definition dihydropyridine comprises the isomers 1,2-, 1,4-, 2,3-, 2,5- and 4,5-dihydropyridine. Preferably dihydropyridinyl denotes 1,2- and 1,4-dihydropyridin-1-yl.

The definition triazole comprises the isomers 1H, 3H- and 4H-[1,2,4]-triazole as well as 1H, 2H- and 4H-[1,2,3]-triazole. The definition triazolyl therefore comprises 1H-[1,2,4]-triazol-1-, 3- and 5-yl, 3H-[1,2,4]-triazol-3- and 5-yl, 4H-[1,2,4]-triazol-3,

- 5 4- and 5-yl, 1H-[1,2,3]-triazol-1, 4- and 5-yl, 2H-[1,2,3]-triazol-2, 4- and 5-yl and 4H-[1,2,3]-triazol-4- and 5-yl.

The term tetrazole comprises the isomers 1H-, 2H- and 5H-tetrazole. The definition tetrazolyl therefore comprises 1H-tetrazol-1- and 5-yl, 2H-tetrazol-2- and

- 10 5-yl as well as 5H-tetrazol-5-yl.

The definition indole comprises the isomers 1H- and 3H-indol. The term indolyl preferably denotes 1H-indol-1-yl.

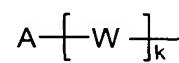
- 15 The definition isoindole comprises the isomers 1H- and 2H-isoindole. The term isoindolyl preferably denotes 2H-isoindol-2-yl.

Generally, the bond to one of the above mentioned heterocyclic groups, particularly to a pyrazolyl, imidazolyl, tetrahydropyridinyl, dihydropyridinyl, triazolyl, 20 tetrazolyl, indolyl or isoindolyl group, may be formed via a C atom or optionally an N atom of an imine function.

The group B is preferably unsubstituted, mono-, di- or trisubstituted by R<sup>20</sup>.

Particularly preferably B is mono- or disubstituted by R<sup>20</sup>. In the event that B is a

- 25 substituted six-membered ring, there is preferably a substituent in the para position to the bond of the group

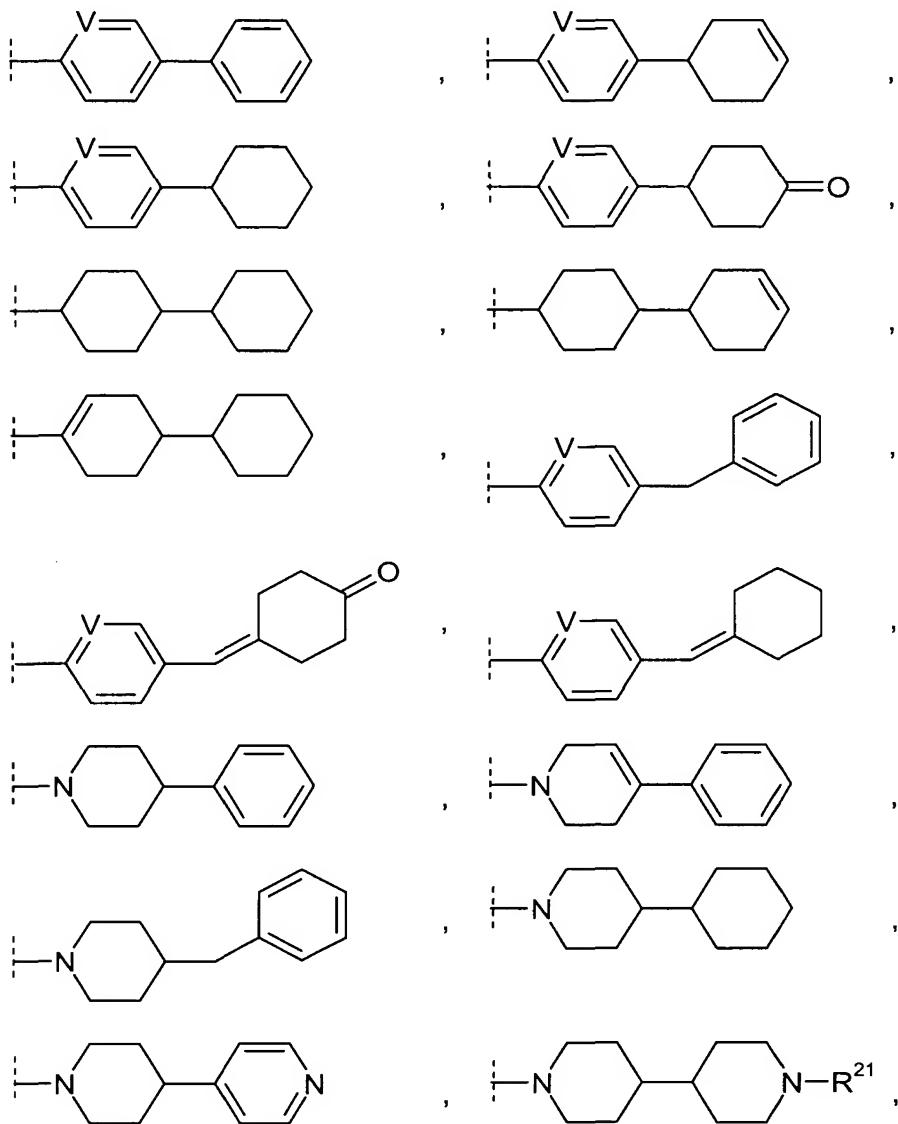


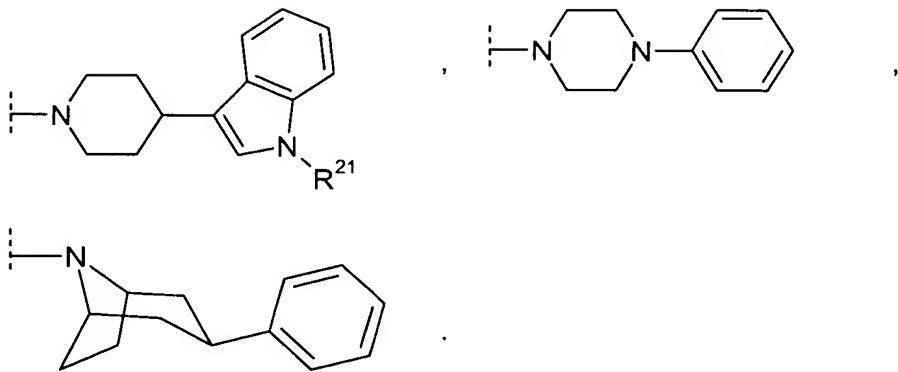
The index k may assume the values 0 or 1. In the preferred case k = 1 the bridge W has the meanings specified, preferably the meanings of a single bond, -CH<sub>2</sub>- or -CH=.

Preferred meanings of partial formula -A-W-B are selected from the

structures mentioned in the following list, where V denotes a C or an N atom, preferably a C atom, and the cyclic groups mentioned may be mono- or polysubstituted at one or more C atoms with R<sup>20</sup> and in the case of phenyl or phenylene groups may also additionally be monosubstituted by nitro:

5

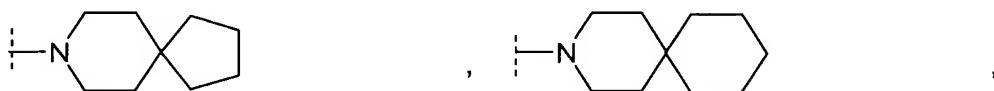


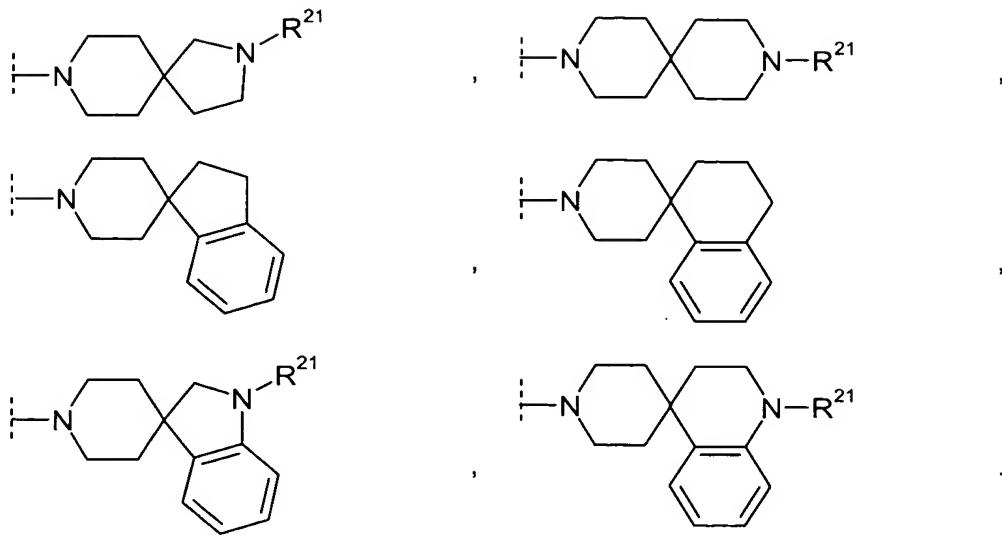


Most particularly preferred are the compounds of formula I, wherein k = 1 and W denotes a single bond.

- 5 The index k may also assume the value 0. According to a first sub-variant the group A is connected to the group B via a common C atom forming a spirocyclic ring system, while the group A denotes a saturated 5- to 7-membered carbo- or heterocyclic group and the group B denotes a saturated 4- to 7-membered carbo- or heterocyclic group, and the heterocyclic groups in each case have an N, O or S atom, and a phenyl or pyridine ring may be fused to a 5- to 7-membered group B via two adjacent C atoms, and the above mentioned cyclic groups may be mono- or polysubstituted by R<sup>20</sup> at one or more C atoms, and in the case of a fused-on phenyl ring may also additionally be monosubstituted by nitro, and/or may be substituted by R<sup>21</sup> at one or more N atoms.
- 10 15 Preferred meanings of partial formula -A-W-B according to this second sub-variant are selected from the structures listed in the following Table, while the cyclic groups listed may be mono- or polysubstituted by R<sup>20</sup> at one or more C atoms and in the case of the phenyl ring may also additionally be monosubstituted by nitro:

20

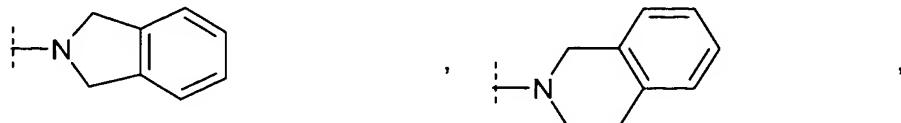


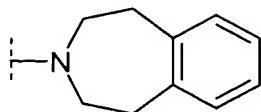


According to a second sub-variant, where  $k = 0$ , the group B is linked to the group A via two common, adjacent atoms forming a fused, bicyclic saturated, unsaturated or aromatic, 8- to 12-membered ring system, which may contain one 5 or more identical or different heteroatoms selected from N, O and/or S, and the bicyclic ring system may be mono- or polysubstituted at one or more C atoms with R<sup>20</sup>, in the case of a fused-on phenyl ring it may also additionally be monosubstituted by nitro, and/or may be substituted by R<sup>21</sup> at one or more N atoms.

10

Preferred meanings of partial formula -A-W-B according to this first sub-variant are selected from the structures listed in the following Table, while the cyclic groups listed may be mono- or polysubstituted by R<sup>20</sup> at one or more C atoms and in the case of the phenyl ring may also additionally be monosubstituted by nitro.





Preferred compounds according to the invention are those wherein one or more of the groups, residues, substituents and/or indices have one of the meanings mentioned above as being preferred.

- 5 Preferred meanings of the substituents R<sup>20</sup> are selected from among fluorine, chlorine, bromine, CF<sub>3</sub>, C<sub>1-4</sub>-alkyl and C<sub>1-4</sub>-alkoxy.

Particularly preferred compounds according to the invention are those wherein

- 10 Y, A independently of one another are selected from among the bivalent cyclic groups 1,4-phenylene, 1,4-cyclohexylene, 1,4-cyclohexenylene, 1,4-piperidinylene, 1,2,3,6-tetrahydro-pyridin-1,4-ylene, 2,5-pyridinylene and 1,4-piperazinylene, while A may also be connected to R<sup>3</sup> according to claim 3, and the above mentioned cyclic groups may be mono- or polysubstituted by R<sup>20</sup> at one or more C atoms, in the case of a phenyl group they may also additionally be monosubstituted by nitro, and/or may be substituted by R<sup>21</sup> at one or more N atoms,

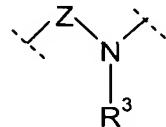
- 15 B denotes phenyl or cyclohexyl, while the above mentioned groups may be mono- or polysubstituted by R<sup>20</sup> and/or the phenyl ring may additionally be monosubstituted by nitro, while R<sup>20</sup> has the meanings given in claim 1, and

- 20 k has the value 1,

- 25 W is a single bond, -CH<sub>2</sub>- or -CH=, and

Z denotes -CH<sub>2</sub>-CH<sub>2</sub>-, -CH<sub>2</sub>-CH(CH<sub>3</sub>)-, -CH<sub>2</sub>-C(CH<sub>3</sub>)<sub>2</sub>-, -CH(CH<sub>3</sub>)-CH<sub>2</sub>-, -C(CH<sub>3</sub>)<sub>2</sub>-CH<sub>2</sub>- or -CH<sub>2</sub>-O- or

is linked to R<sup>3</sup> in such a way that the group of partial formula

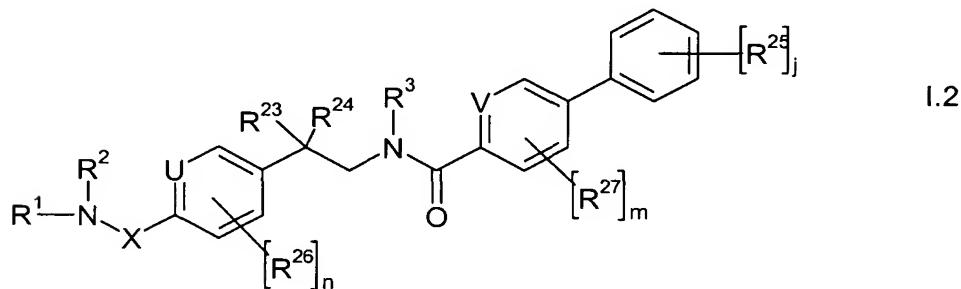
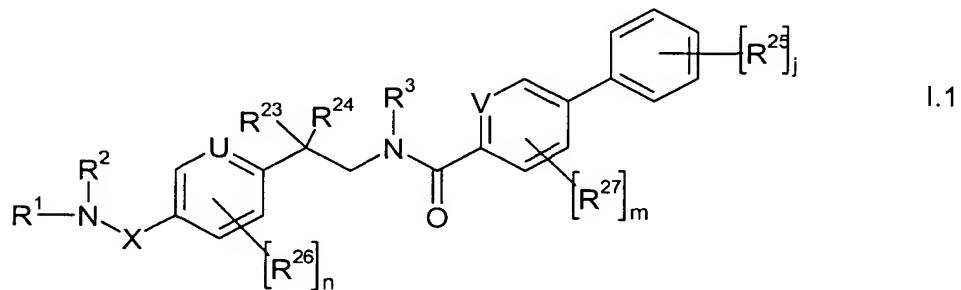


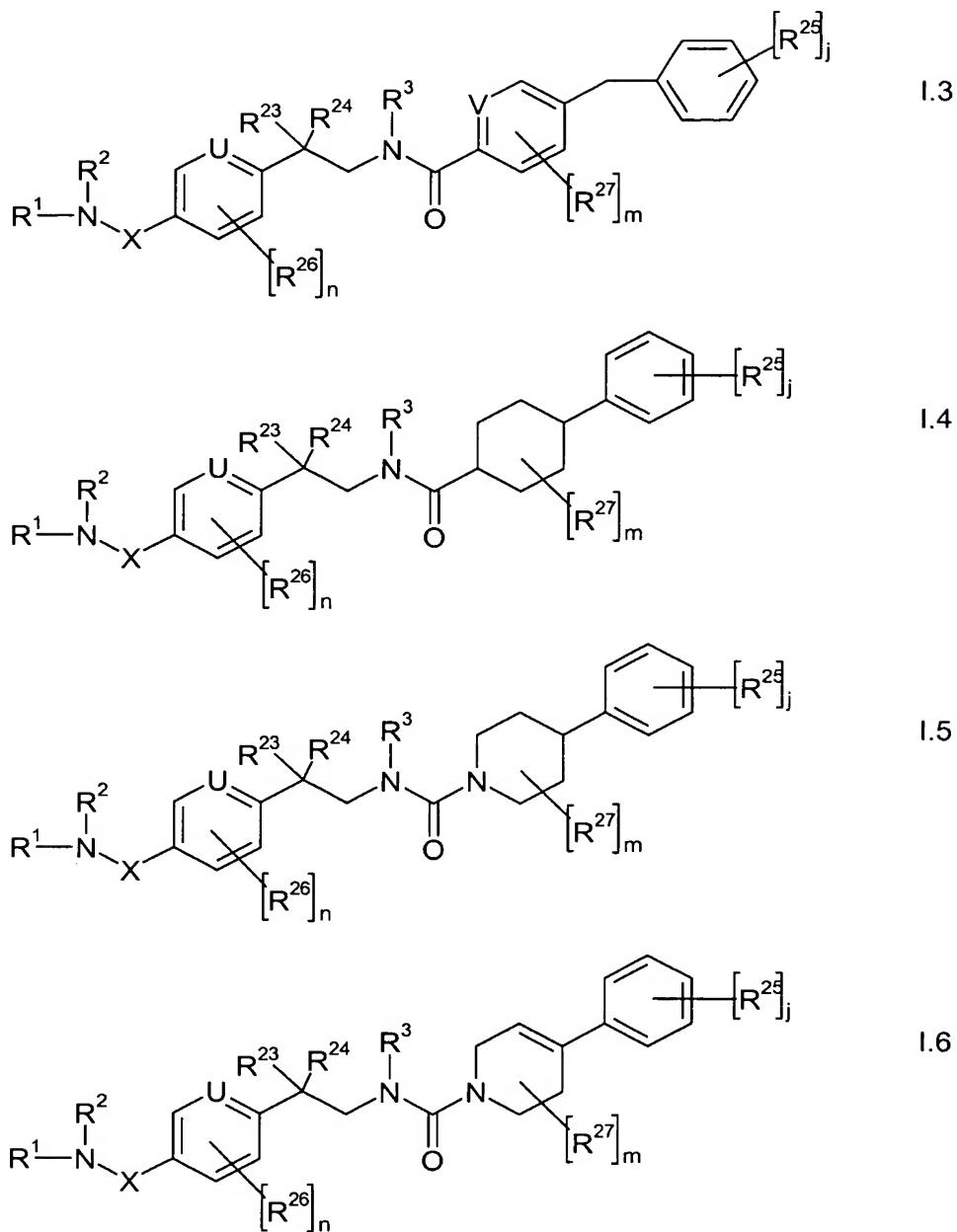
of formula I has a meaning selected from

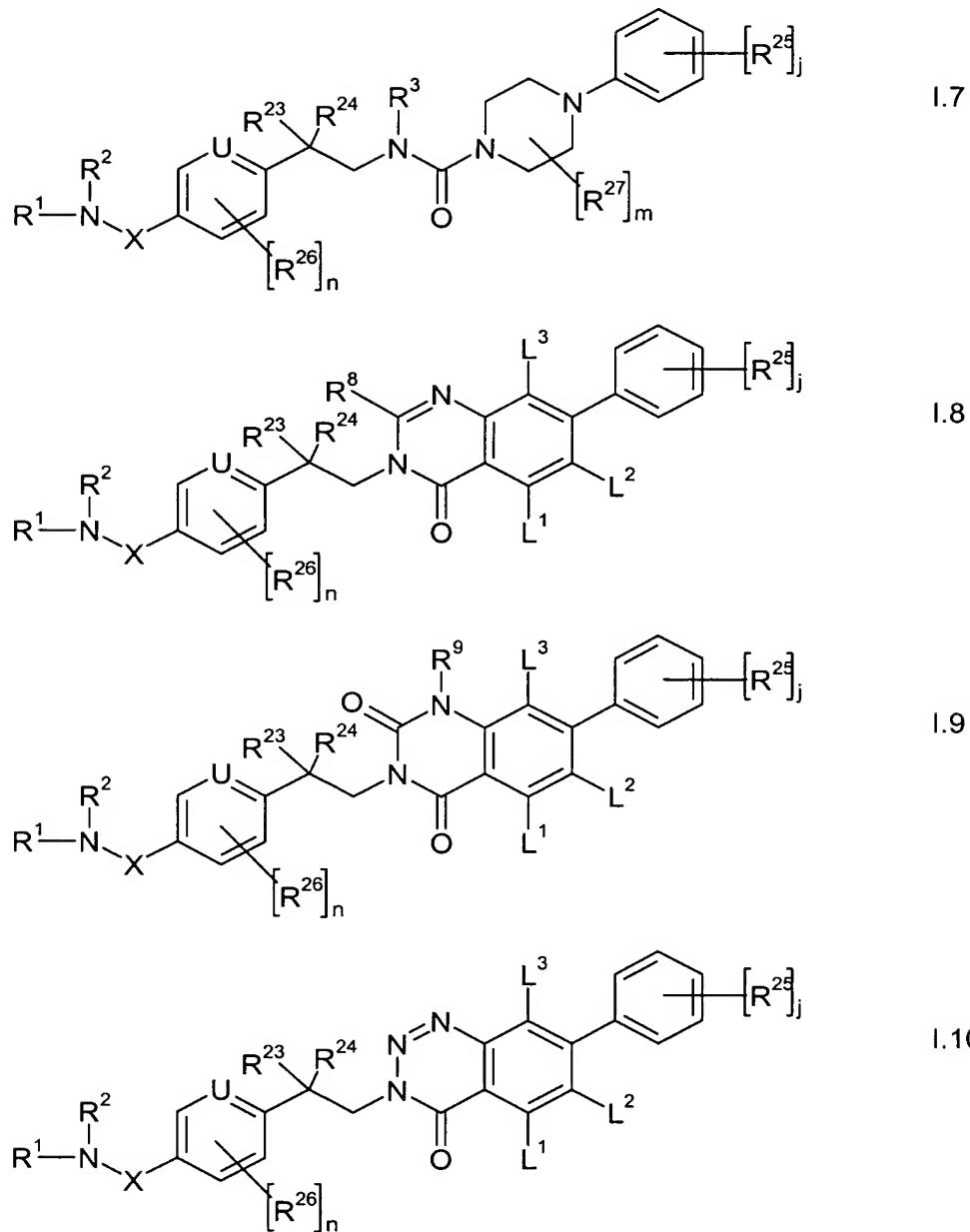
5

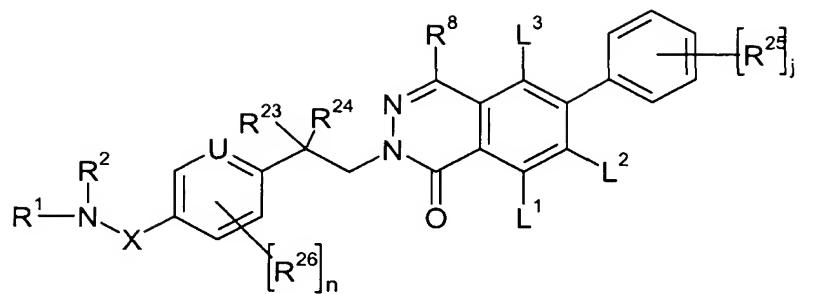
1,3-pyrrolidinylene and 1,3-piperidinylene.

Particularly preferred compounds according to the invention are listed in the following group of formulae I.1 to I.14:

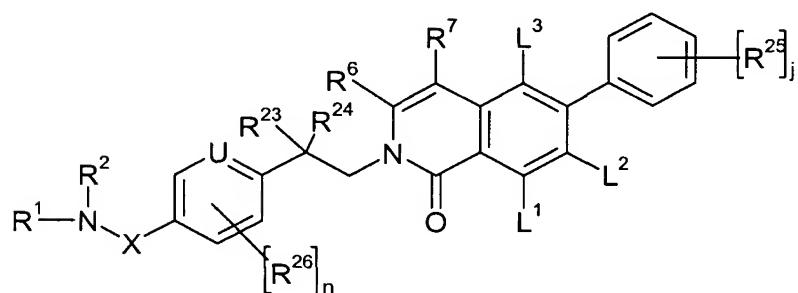




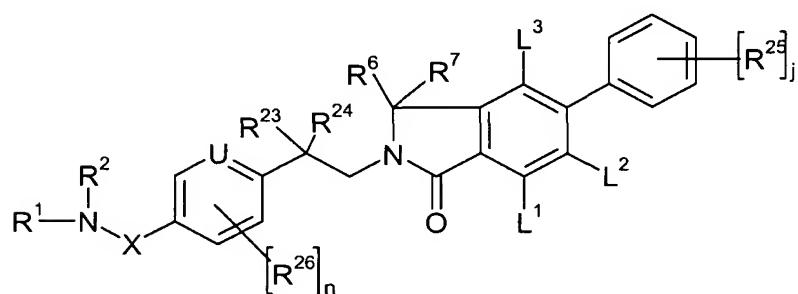




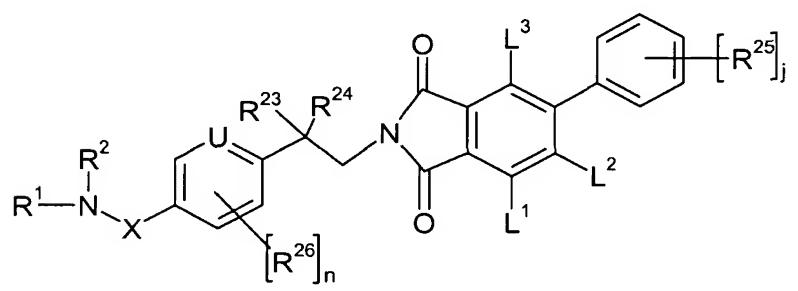
I.11



I.12



I.13



I.14

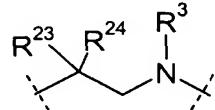
wherein

U, V independently of one another denote C or N,

$R^{23}, R^{24}$  independently of one another denote H, F, methyl, trifluoromethyl, ethyl, iso-propyl or n-propyl,

while in formulae I.1 to I.6  $R^{24}$  may be linked to  $R^3$  in such a way

that the group of partial formula



5 has a meaning selected from 1,3-pyrrolidinylene and 1,3-piperidinylene, and

$R^{25}$ ,

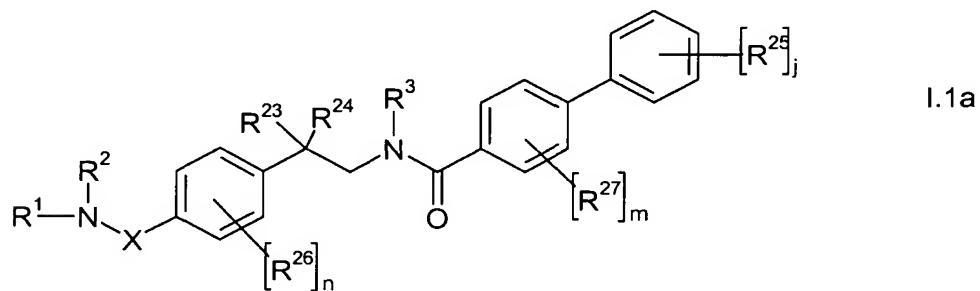
10  $R^{26}, R^{27}$  independently of one another have one of the meanings given for  $R^{20}$  or in the case of a phenyl group also simply denote nitro, while residues  $R^{25}, R^{26}, R^{27}$  occurring several times may have identical or different meanings, and

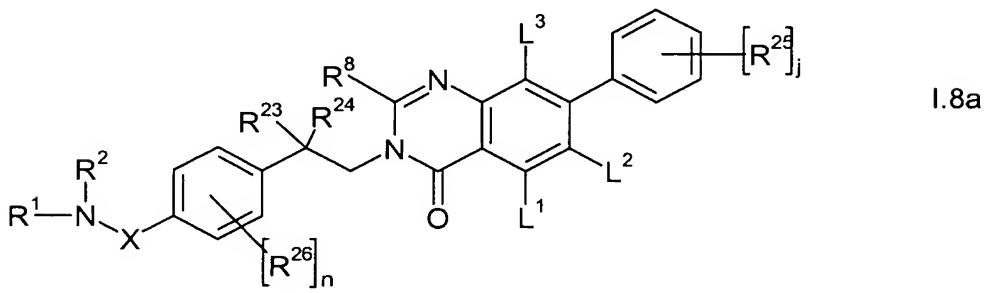
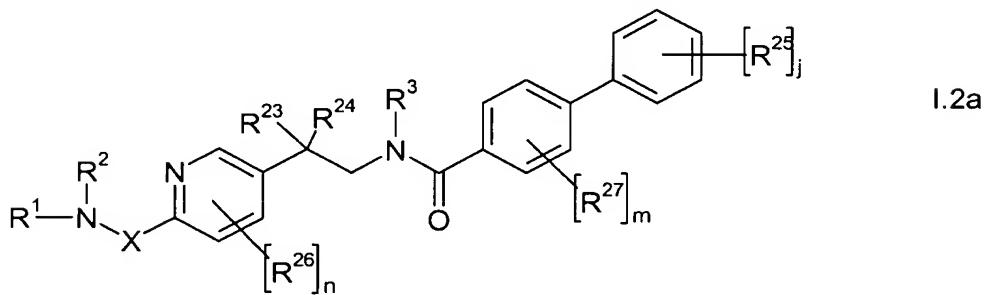
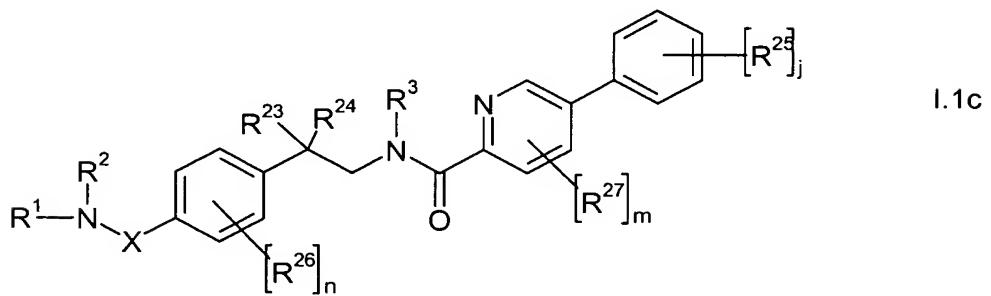
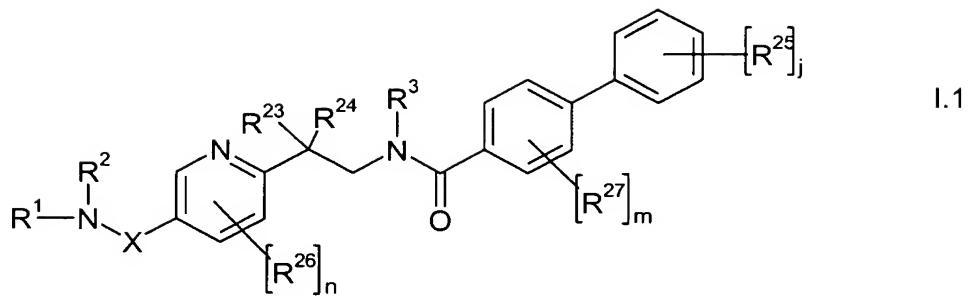
j is 0, 1, 2, 3 or 4 and

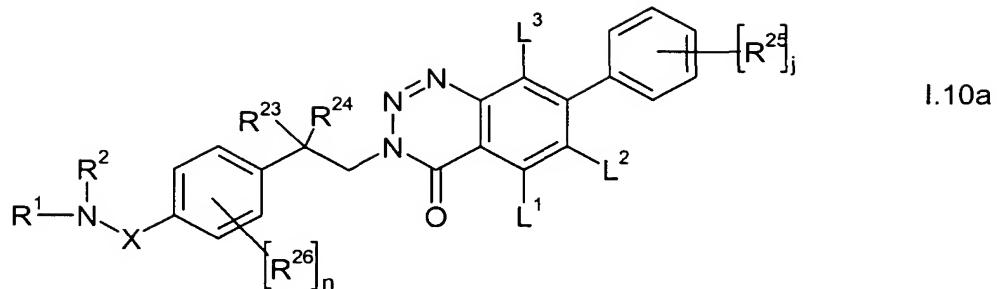
15

m, n independently of one another represent 0, 1 or 2.

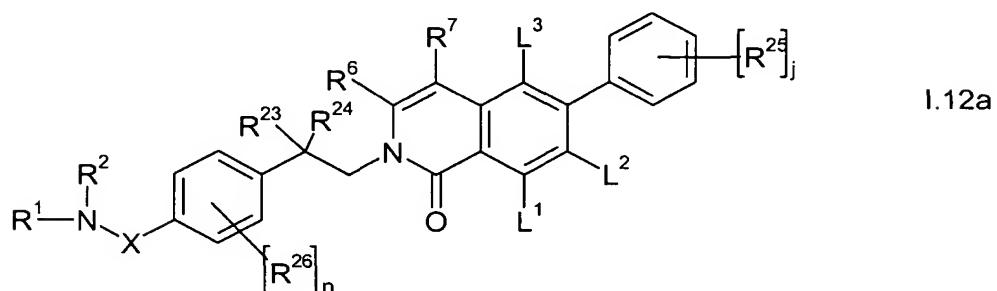
Most particularly preferred are compounds according to the above formulae I.1, I.2, I.8, I.10 and I.12. In particular, especially preferred compounds may be 20 described by the following formulae







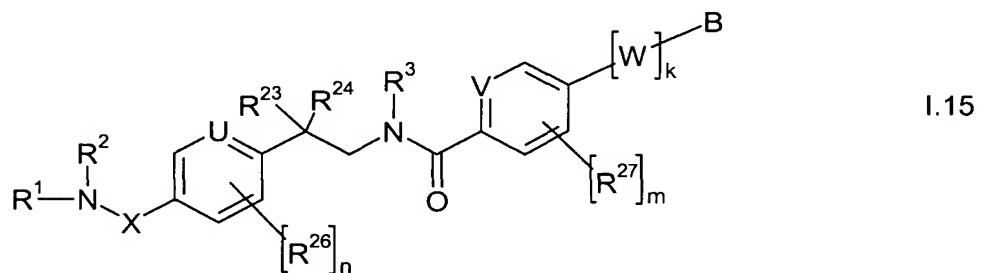
I.10a



I.12a

wherein the groups and substituents are defined as above and hereinafter.

Also preferred according to the invention are compounds of the following partial  
5 formula



I.15

wherein

- 10 B is selected from among C<sub>1-6</sub>-alkyl, C<sub>1-6</sub>-alkenyl, C<sub>1-6</sub>-alkynyl, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkyl, C<sub>3-7</sub>-cycloalkenyl-C<sub>1-3</sub>-alkyl, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkenyl or C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkynyl, wherein one or more C atoms may

be mono- or polysubstituted by halogen and/ or monosubstituted by hydroxy or cyano and/ or cyclic groups may be mono- or polysubstituted by R<sup>20</sup>, and

5 W denotes a single bond, -O-, a C<sub>1-4</sub>-alkylene, C<sub>2-4</sub>-alkenylene, C<sub>2-4</sub>-alkynylene, C<sub>1-4</sub>-alkylenoxy, Oxy-C<sub>1-4</sub>-alkylene, C<sub>1-3</sub>-alkylene-oxy-C<sub>1-3</sub>-alkylene, imino, N-(C<sub>1-3</sub>-alkyl)-imino-, imino-C<sub>1-4</sub>-alkylene-, N-(C<sub>1-3</sub>-alkyl)-imino-C<sub>1-4</sub>-alkylene-, C<sub>1-4</sub>-alkylene-imino- or C<sub>1-4</sub>-alkylene-N-(C<sub>1-3</sub>-alkyl)-imino-group, while one or two C atoms independently of one another may  
10 be substituted with a hydroxy, ω-hydroxy-C<sub>1-3</sub>-alkyl, ω-(C<sub>1-3</sub>-alkoxy)-C<sub>1-3</sub>-alkyl and/ or C<sub>1-3</sub>-alkoxy group and/or with one or two identical or different C<sub>1-4</sub>-alkyl groups, and

15 k denotes 0 or 1.

Moreover, according to this embodiment, compounds are preferred wherein the group B denotes C<sub>1-6</sub>-alkyl, C<sub>1-6</sub>-alkynyl, C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkyl- or C<sub>3-7</sub>-cycloalkyl-C<sub>1-3</sub>-alkynyl-, wherein one or more C atoms may be mono- or polysubstituted by halogen and/ or monosubstituted by hydroxy or cyano and/ or  
20 cyclic groups may be mono- or polysubstituted by R<sup>20</sup>, and/ or

25 W denotes a single bond, -O-, imino or N-(C<sub>1-3</sub>-alkyl)-imino-, while one or two C atoms independently of one another may be substituted with a hydroxy, ω-hydroxy-C<sub>1-3</sub>-alkyl, ω-(C<sub>1-3</sub>-alkoxy)-C<sub>1-3</sub>-alkyl and/ or C<sub>1-3</sub>-alkoxy group and/or with one or two identical or different C<sub>1-4</sub>-alkyl groups and k = 1.

Most particularly preferred meanings for the group -W-B according to this embodiment are selected from among C<sub>1-8</sub>-alkyl, -C≡C-C<sub>1-6</sub>-alkyl, -CH=CH-C<sub>1-6</sub>-alkyl, -O-C<sub>1-6</sub>-alkyl, -NH(C<sub>1-6</sub>-alkyl) and -N(C<sub>1-6</sub>-alkyl)(C<sub>1-3</sub>-alkyl), particularly  
30 selected from among C<sub>3-8</sub>-alkyl, -C≡C-C<sub>3-6</sub>-alkyl, -CH=CH-C<sub>3-6</sub>-alkyl, -O-C<sub>3-6</sub>-alkyl, -NH(C<sub>3-6</sub>-alkyl) and -N(C<sub>3-6</sub>-alkyl)(C<sub>1-3</sub>-alkyl).

Particularly preferred among the compounds according to the invention previously described as being preferred, particularly of partial formulae I.1 to I.15, are those wherein the groups R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> and/or group X have one of the meanings

- 5 mentioned as being preferred in each case.

In particular, especially preferred compounds according to the invention are those compounds wherein X is selected from -CH<sub>2</sub>-, -CH(CH<sub>3</sub>)- or -C(CH<sub>3</sub>)<sub>2</sub>-.

- 10 Also particularly preferred are those compounds of partial formulae I.1 to I.15 wherein

- a) the group U denotes an N atom and the group V denotes a C atom, or
- b) the group U denotes a C atom and the group V denotes an N atom, or
- c) the two groups U and V each denote a C atom.

15

In particularly preferred compounds according to the invention the substituents R<sup>25</sup>, R<sup>26</sup>, R<sup>27</sup> independently of one another have a meaning selected from among F, Cl, Br, I, OH, cyano, methyl, difluoromethyl, trifluoromethyl, ethyl, n-propyl, iso-propyl, methoxy, difluoromethoxy, trifluoromethoxy, ethoxy, n-propoxy or iso-

- 20 propoxy, and also, in the case of the substitution of a phenyl group, simply nitro, while R<sup>25</sup>, R<sup>26</sup>, R<sup>27</sup> occurring several times may have identical or different meanings, and j is 0, 1 or 2, and m, n independently of one another denote 0 or 1.

Preferred meanings of the groups R<sup>6</sup>, R<sup>7</sup>, R<sup>8</sup> and/or R<sup>9</sup> in the compounds

- 25 described as preferred according to the invention are, independently of one another, H, methyl, trifluoromethyl, ethyl, iso-propyl or n-propyl, and also F in the case of R<sup>6</sup> and R<sup>7</sup>.

Particularly preferred individual compounds are selected from the group

- (1) 7-(4-chloro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-

ethyl]-3*H*-quinazolin-4-one

- (2) 3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-7-*p*-tolyl-3*H*-quinazolin-4-one
- (3) 3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-7-(4-trifluormethyl-phenyl)-3*H*-quinazolin-4-one
- (4) 7-(4-methoxy-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one
- (5) 7-(3,4-dichloro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one
- (6) 7-(4-fluoro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one
- (7) 7-(4-ethyl-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one
- (8) 2-methyl-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-7-(4-trifluoromethyl-phenyl)-3*H*-quinazolin-4-one
- (9) 2-methyl-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-7-*p*-tolyl-3*H*-quinazolin-4-one
- (10) 7-(4-chloro-phenyl)-2-methyl-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one
- (11) 7-(4-chloro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-1*H*-quinazolin-2,4-dione
- (12) 7-(4-chloro-phenyl)-3-{2-[4-((S)-2-methoxymethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-quinazolin-4-one
- (13) 7-(4-chloro-phenyl)-3-[2-(4-dimethylaminomethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one
- (14) 7-(4-chloro-phenyl)-3-[2-(4-piperidin-1-ylmethyl-phenyl)-

ethyl]-3*H*-quinazolin-4-one

- (15) 7-(4-chloro-phenyl)-3-[2-(4-morpholin-4-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one
- (16) 7-(4-chloro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-benzo[*d*][1,2,3]triazin-4-one
- (17) 5-(4-fluoro-phenyl)-2-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-isoindol-1,3-dione
- (18) 4'-chloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (19) 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-diethylaminomethyl-phenyl)-ethyl]-amide
- (20) 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-piperidin-1-ylmethyl-phenyl)-ethyl]-amide
- (21) 4'-methoxy-biphenyl-4-carboxylic acid-[2-(4-diethylaminomethyl-phenyl)-ethyl]-amide
- (22) 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-diethylaminomethyl-phenyl)-ethyl]-methyl-amide
- (23) 4-(4-chloro-phenyl)-cyclohexanecarboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (24) 4-methylphenyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (25) 4-(4-chloro-phenyl)-3,6-dihydro-2*H*-pyridine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (26) 4-(4-chloro-phenyl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (27) 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-

ylmethyl-phenyl)-propyl]-amide

- (28) 4'-chloro-biphenyl-4-carboxylic acid-(4-pyrrolidin-1-ylmethyl-benzyloxy)-amide
- (29) 4-cyclohexyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide
- (30) 4'-chloro-biphenyl-4-carboxylic acid-[2-(3-methoxy-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (31) 7-(4-chloro-phenyl)-3-{2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethyl}-3H-quinazolin-4-one
- (32) 4'-chloro-biphenyl-4-carboxylic acid-{2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethyl}-amide
- (33) 7-(3-methoxy-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3H-quinazolin-4-one
- (34) 4-(4-oxo-cyclohexyl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide
- (35) 4-cyclohexyl-1-cyclohexylcarboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (36) 4-benzyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (37) 4-cyclohexyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (38) 4-(4-chloro-phenyl)-piperazine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (39) 4-(4-fluoro-phenyl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (40) 4-(4-methoxy-phenyl)-piperazine-1-carboxylic acid-[2-(4-

pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

- (41) 4-phenyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (42) (4'-chloro-biphenyl-4-yl)-[3-(4-pyrrolidin-1-ylmethyl-phenyl)-piperidin-1-yl]-methanone
- (43) 4'-chloro-biphenyl-4-carboxylic acid-[2-methyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-propyl]-amide
- (44) 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-cyclohexyl)-ethyl]-amide
- (45) 4-benzyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide
- (46) 4-(4-oxo-cyclohexylidenemethyl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide
- (47) 4'-chloro-biphenyl-4-carboxylic acid-[2-(2-fluoro-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (48) 5-(4-chloro-phenyl)-2-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-2,3-dihydro-isoindol-1-one
- (49) 4-piperidin-1-yl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide
- (50) 7-(4-chloro-phenyl)-3-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-3H-benzo[d][1,2,3]triazin-4-one
- (51) 7-(4-chloro-phenyl)-3-{2-[4-(3-Aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethyl}-3H-quinazolin-4-one
- (52) 7-(4-chloro-phenyl)-3-{2-[4-(3-aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethyl}-3H-benzo[d][1,2,3]triazin-4-one
- (53) 7-(4-chloro-phenyl)-3-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-

ylmethyl)-phenyl]-ethyl}-3*H*-quinazolin-4-one

- (54) 7-(4-chloro-phenyl)-3-(2-{4-[4-(pyridin-2-yloxy)-piperidin-1-ylmethyl]-phenyl}-ethyl)-3*H*-quinazolin-4-one
- (55) 6-(4-chloro-phenyl)-2-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-2*H*-isoquinolin-1-one
- (56) 4'-chloro-biphenyl-4-carboxylic acid [2-(3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (57) 4'-chloro-biphenyl-4-carboxylic acid [2-(3-methyl-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (58) 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(1-ethyl-piperidin-2-yl)-phenyl]-ethyl}-amide
- (59) 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(4-acetyl-piperazin-1-ylmethyl)-phenyl]-ethyl}-amide
- (60) 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(2-aza-bicyclo[2.2.1]hept-5-en-2-ylmethyl)-phenyl]-ethyl}-amide
- (61) 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(1,3-dihydro-isoindol-2-ylmethyl)-phenyl]-ethyl}-amide
- (62) 4'-chloro-biphenyl-4-carboxylic acid (2-{4-[(diisopropylamino)-methyl]-phenyl}-ethyl)-amide
- (63) 4'-chloro-biphenyl-4-carboxylic acid {2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-amide
- (64) 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(2-dimethylaminomethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide
- (65) 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(3-dimethylamino-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide

- (66) 4'-chloro-biphenyl-4-carboxylic acid [2-(2-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (67) 4-pent-1-ynyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide
- (68) 4'-chloro-biphenyl-4-carboxylic acid [2-(6-pyrrolidin-1-ylmethyl-pyridin-3-yl)-ethyl]-amide
- (69) 4'-chloro-biphenyl-4-carboxylic acid [2-(1-pyrrolidin-1-yl-indan-5-yl)-ethyl]-amide
- (70) 4'-chloro-biphenyl-4-carboxylic acid [2-(2-nitro-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (71) 2',4'-dichloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (72) 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(3-amino-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide
- (73) 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(2-aminomethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide
- (74) 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(2-methyl-2,6-diaza-spiro[3.4]oct-6-ylmethyl)-phenyl]-ethyl}-amide
- (75) 4'-chloro-biphenyl-4-carboxylic acid [2-(5-pyrrolidin-1-ylmethyl-pyridin-2-yl)-ethyl]-amide
- (76) 4'-chloro-biphenyl-4-carboxylic acid [2-(3-ethyl-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (77) 4'-bromo-biphenyl-4-carboxylic acid {2-[4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-amide
- (78) 4-(5-chloro-thiophen-2-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

- (79) 4'-chloro-biphenyl-4-carboxylic acid [2-(2-methyl-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (80) 4'-bromo-3-fluoro-biphenyl-4-carboxylic acid {2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-amide
- (81) 4'-chloro-2-fluoro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (82) 4'-ethyl-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (83) tert.butyl [1-(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-pyrrolidin-2-ylmethyl]-carbaminate
- (84) 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(2-methyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide
- (85) 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(2-methyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide
- (86) 4'-chloro-biphenyl-4-carboxylic acid (2-{4-[(cyclopropylmethyl-amino)-methyl]-phenyl}-ethyl)-amide
- (87) 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(3,4-dihydro-1H-isoquinolin-2-ylmethyl)-phenyl]-ethyl}-amide
- (88) 4'-chloro-biphenyl-4-carboxylic acid [2-(4-{{(2-hydroxy-ethyl)-methyl-amino}-methyl}-phenyl)-ethyl]-amide
- (89) tert.butyl [1-(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-pyrrolidin-3-yl]-carbaminate
- (90) 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(2,6-dimethyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide
- (91) 4'-chloro-biphenyl-4-carboxylic acid [2-(4-azetidin-1-ylmethyl-phenyl)-ethyl]-amide

- (92) 3,4'-dichloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (93) 4'-fluoro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (94) 4'-chloro-3-fluoro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (95) 2'-fluoro-4'-chloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (96) 5-(4-chloro-phenyl)-pyridine-2-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (97) 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-amide
- (98) 4'-bromo-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide
- (99) 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethyl}-amide

Most particularly preferred are the above mentioned individual compounds of formulae (1), (2), (3), (4), (5), (6), (7), (8), (9), (10), (11), (12), (13), (14), (15), (16), (17), (18), (19), (20), (21), (22), (23), (24), (25), (26), (27), (28), (29), (30),  
5 (47) as well as (50) to (99).

Some expressions used hereinbefore and below to describe the compounds according to the invention will now be defined more fully.

- 10 The term halogen denotes an atom selected from among F, Cl, Br and I.

The term  $C_{1-n}$ -alkyl, where n has a value of 3 to 8, denotes a saturated, branched or unbranched hydrocarbon group with 1 to n C atoms. Examples of such groups include methyl, ethyl, n-propyl, iso-propyl, butyl, iso-butyl, sec-butyl, tert-butyl, n-pentyl, iso-pentyl, neo-pentyl, tert-pentyl, n-hexyl, iso-hexyl, etc.

5

The term  $C_{1-n}$ -alkylene, where n may have a value of 1 to 8, denotes a saturated, branched or unbranched hydrocarbon bridge with 1 to n C atoms. Examples of such groups include methylene (-CH<sub>2</sub>-), ethylene (-CH<sub>2</sub>-CH<sub>2</sub>-), 1-methyl-ethylene (-CH(CH<sub>3</sub>)-CH<sub>2</sub>-), 1,1-dimethyl-ethylene (-C(CH<sub>3</sub>)<sub>2</sub>-CH<sub>2</sub>-), n-prop-1,3-ylene (-CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>-), 1-methylprop-1,3-ylene (-CH(CH<sub>3</sub>)-CH<sub>2</sub>-CH<sub>2</sub>-), 2-methylprop-1,3-ylene (-CH<sub>2</sub>-CH(CH<sub>3</sub>)-CH<sub>2</sub>-), etc., as well as the corresponding mirror-symmetrical forms.

10

The term  $C_{2-n}$ -alkenyl, where n has a value of 3 to 6, denotes a branched or unbranched hydrocarbon group with 2 to n C atoms and at least one C=C-double bond. Examples of such groups include vinyl, 1-propenyl, 2-propenyl, iso-propenyl, 1,3-butadienyl, 1-butenyl, 2-butenyl, 3-butenyl, 2-methyl-1-propenyl, 1-pentenyl, 2-pentenyl, 3-pentenyl, 4-pentenyl, 3-methyl-2-butenyl, 1-hexenyl, 2-hexenyl, 3-hexenyl, 2,4-hexadienyl, 5-hexenyl etc.

15

20

The term  $C_{1-n}$ -alkoxy denotes a -O-C<sub>1-n</sub>-alkyl group, wherein C<sub>1-n</sub>-alkyl is defined as above. Examples of such groups include methoxy, ethoxy, n-propoxy, iso-propoxy, n-butoxy, iso-butoxy, sec-butoxy, tert-butoxy, n-pentoxyl, iso-pentoxyl, neo-pentoxyl, tert-pentoxyl, n-hexoxy, iso-hexoxy etc.

25

The term  $C_{1-n}$ -alkylthio denotes an -S-C<sub>1-n</sub>-alkyl group, wherein C<sub>1-n</sub>-alkyl is defined as above. Examples of such groups include methylthio, ethylthio, n-propylthio, iso-propylthio, n-butylthio, iso-butylthio, sec-butylthio, tert-butylthio, n-pentylthio, iso-pentylthio, neo-pentylthio, tert-pentylthio, n-hexylthio, iso-hexylthio, etc.

30

The term  $C_{1-n}$ -alkylcarbonyl denotes a  $-C(=O)-C_{1-n}$ -alkyl group, wherein  $C_{1-n}$ -alkyl is defined as above. Examples of such groups include methylcarbonyl, ethylcarbonyl, n-propylcarbonyl, iso-propylcarbonyl, n-butylcarbonyl, iso-butylcarbonyl, sec-butylcarbonyl, tert-butylcarbonyl, n-pentylcarbonyl, iso-

- 5 pentylcarbonyl, neo-pentylcarbonyl, tert-pentylcarbonyl, n-hexylcarbonyl, iso-hexylcarbonyl, etc.

The term  $C_{3-n}$ -cycloalkyl denotes a saturated mono-, bi-, tri- or spirocyclic group with 3 to n C atoms. Examples of such groups include cyclopropyl,

- 10 cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclododecyl, bicyclo[3.2.1.]octyl, spiro[4.5]decyl, norpinyl, norbonyl, norcaryl, adamanyl, etc.

The term  $C_{3-n}$ -cycloalkylcarbonyl denotes a  $-C(=O)-C_{3-n}$ -cycloalkyl group, wherein

- 15  $C_{3-n}$ -cycloalkyl is defined as above.

The term aryl denotes a carbocyclic, aromatic ring system, such as for example phenyl, biphenyl, naphthyl, anthracenyl, phenanthrenyl, fluorenyl, indenyl, pentalenyl, azulenyl, biphenylenyl, etc.

- 20 The term heteroaryl used in this application denotes a heterocyclic, aromatic ring system which comprises in addition to at least one C atom one or more heteroatoms selected from N, O and/or S. Examples of such groups are furanyl, thiophenyl (thienyl), pyrrolyl, oxazolyl, thiazolyl, imidazolyl, isoxazolyl, isothiazolyl, 1,2,3-triazolyl, 1,3,5-triazolyl, pyranyl, pyridyl, pyridazinyl, pyrimidinyl, pyrazinyl, 1,2,3-triazinyl, 1,2,4-triazinyl, 1,3,5-triazinyl, 1,2,3-oxadiazolyl, 1,2,4-oxadiazolyl, 1,2,5-oxadiazolyl, 1,3,4-oxadiazolyl, 1,2,3-thiadiazolyl, 1,2,4-thiadiazolyl, 1,2,5-thiadiazolyl, 1,3,4-thiadiazolyl, tetrazolyl, thiadiazinyl, indolyl, isoindolyl, benzofuranyl, benzothiophenyl (thianaphthetyl), indazolyl, benzimidazolyl, 25 benzthiazolyl, benzisothiazolyl, benzoxazolyl, benzisoxazolyl, purinyl, quinazolinyl, quinozilinyl, quinolinyl, isoquinolinyl, quinoxalinyl, naphthyridinyl, pteridinyl,
- 30 benzthiazolyl, benzisothiazolyl, benzoxazolyl, benzisoxazolyl, purinyl, quinazolinyl, quinozilinyl, quinolinyl, isoquinolinyl, quinoxalinyl, naphthyridinyl, pteridinyl,

carbazolyl, azepinyl, diazepinyl, acridinyl, etc. The term heteroaryl also comprises the partially hydrogenated heterocyclic, aromatic ring systems, particularly those listed above. Examples of such partially hydrogenated ring systems are 2,3-dihydrobenzofuranyl, pyrolinyl, pyrazolinyl, indolinyl, oxazolidinyl, oxazolinyl,  
5 oxazepinyl, etc.

Terms such as aryl-C<sub>1-n</sub>-alkyl, heteroaryl-C<sub>1-n</sub>-alkyl, etc. refer to C<sub>1-n</sub>-alkyl, as defined above, which is substituted with an aryl or heteroaryl group.  
Many of the terms given above may be used repeatedly in the definition of a  
10 formula or group and in each case have one of the meanings given above, independently of one another.

The term "unsaturated carbocyclic group" or "unsaturated heterocyclic group", as used particularly in the definition of the group Cy, comprises in addition to the  
15 totally unsaturated groups, the corresponding, only partially unsaturated groups, particularly mono- and diunsaturated groups.

The term "optionally substituted" used in this application indicates that the group thus designated is either unsubstituted or mono- or polysubstituted by the  
20 substituents specified. If the group in question is polysubstituted, the substituents may be identical or different.

The residues and substituents described above may be mono- or polysubstituted by fluorine as described. Preferred fluorinated alkyl groups are fluoromethyl,  
25 difluoromethyl and trifluoromethyl. Preferred fluorinated alkoxy groups are fluoromethoxy, difluoromethoxy and trifluoromethoxy. Preferred fluorinated alkylsulphinyl and alkylsulphonyl groups are trifluoromethylsulphinyl and trifluoromethylsulphonyl.

30 The compounds of general formula I according to the invention may have acid groups, predominantly carboxyl groups, and/or basic groups such as e.g. amino

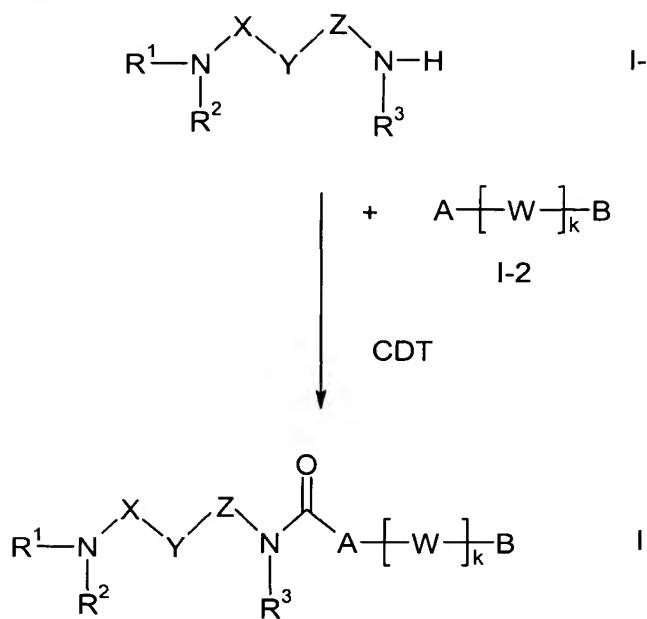
functions. Compounds of general formula I may therefore be present as internal salts, as salts with pharmaceutically useable inorganic acids such as hydrochloric acid, sulphuric acid, phosphoric acid, sulphonic acid or organic acids (such as for example maleic acid, fumaric acid, citric acid, tartaric acid or acetic acid) or as  
5 salts with pharmaceutically useable bases such as alkali or alkaline earth metal hydroxides or carbonates, zinc or ammonium hydroxides or organic amines such as e.g. diethylamine, triethylamine, triethanolamine *inter alia*.

The compounds according to the invention may be obtained using methods of  
10 synthesis which are known in principle. Preferably the compounds are obtained by the method of preparation described above and explained more fully hereinafter.

The method of preparation according to the invention to obtain the first group of the preferred embodiments, i.e. those compounds in which the group A and the  
15 group R<sup>3</sup> are not directly linked to one another, basically distinguishes between two cases.

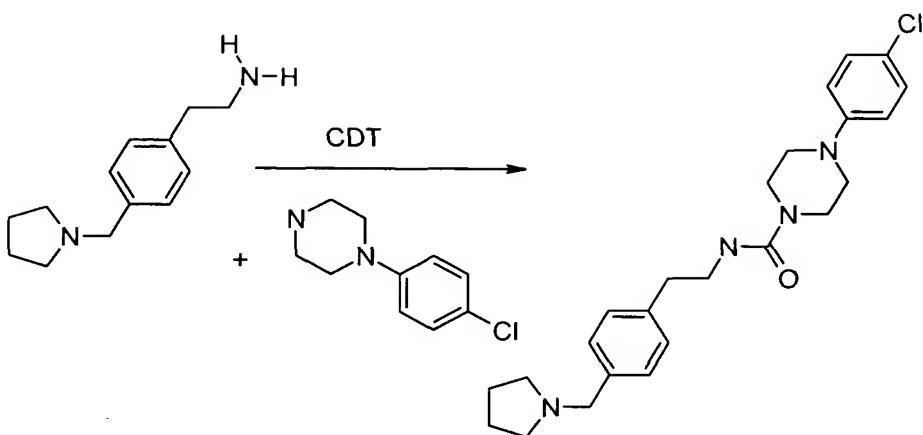
The first case covers those compounds of formula I wherein the group A denotes a nitrogen-heterocyclic group connected via a nitrogen atom to the carboxamide  
20 group, which may comprise in addition to the nitrogen atom one or more heteroatoms selected from N, O and S. The reaction of the amine of formula I-1 with the secondary amine of formula I-2 is illustrated in the following general reaction plan:

Reaction plan 1:



- Preferably the amine compound of formula I-1 is first reacted with CDT (1,1'-carbonyldi-(1,2,4-triazole)) in a solvent or mixture of solvents and then the reaction mixture is further reacted with the amine compound of formula I-2, while the minimum of one base is added to the reaction mixture before and/or after the reaction of the amine compound with CDT. Advantageously the amine compound of formula I-1 is reacted with CDT in a temperature range of -20°C to 20°C and then this reaction mixture is reacted with the amine compound of formula I-2 in a temperature range of 40°C to 100°C in a molar ratio of the amine compound of formula I-1 : amine compound of formula I-2 : CDT : base of 1 ± 0.25 : 1 ± 0.25 : 1 ± 0.25 : 3 ± 1.5. Preferably nitrogen bases, particularly tert. amine, such as for example triethylamine, are used as bases.
- 15 The amine compound of formula I-2 may be a saturated N-heterocyclic compound, such as for example a piperazine derivative according to the following reaction plan 2.

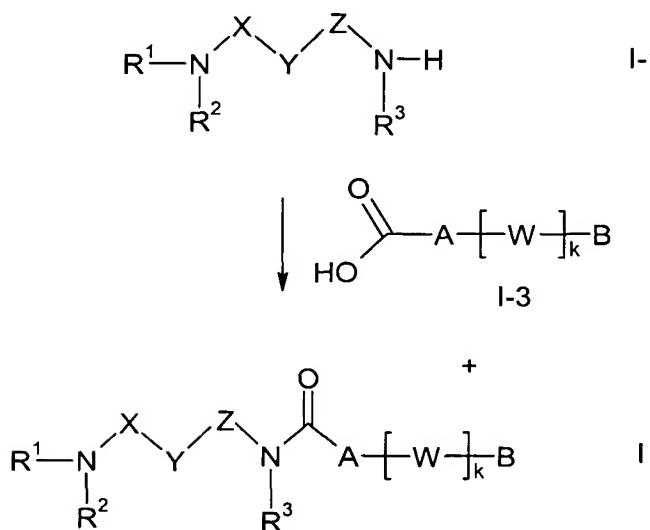
Reaction plan 2



The second case of preparation processes covers the other compounds of formula I which are not covered by case 1, wherein the group A is not directly linked to R<sup>3</sup>.

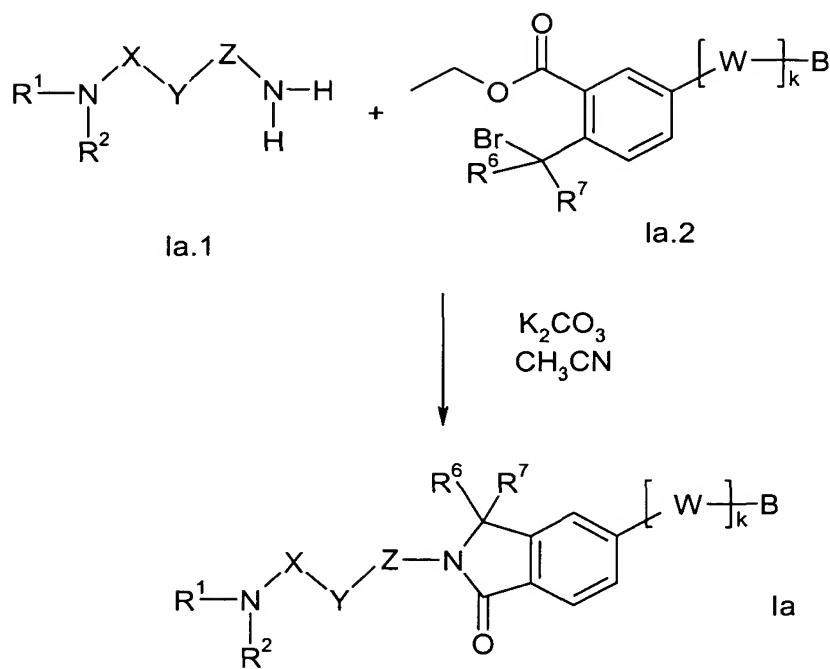
- 5 The reaction of the carboxylic acid compound of formula I-3 with TBTU (2-(1H-benzotriazol-1-yl)-1,1,3,3-tetramethyluronium-tetrafluoroborate) and the amine compound of formula I-1 in a solvent or mixture of solvents in the presence of at least one base is shown in reaction plan 3.

10 Reaction plan 3:



- Preferably the carboxylic acid compound of formula I-3 is reacted with TBTU in a solvent or mixture of solvents and then the reaction mixture is further reacted with the amine compound of formula I-1, while the minimum of one base is added to the reaction mixture before and/or after the reaction of the carboxylic acid
- 5     compound with TBTU. Instead of a carboxylic acid it is also possible to use the corresponding activated carboxylic acid derivatives, such as for example esters, ortho-esters, carboxylic acid chlorides or anhydrides. Preferably the base used is a nitrogen base, particularly a tert.-amine, such as for example triethylamine.
- Advantageously the carboxylic acid compound of formula I-3 is reacted with TBTU
- 10    and then this reaction mixture is used with the amine compound of formula I-1 in a temperature range of 0°C to 60°C in a molar ratio of the carboxylic acid compound of formula I-3 : amine compound of formula I-1 : TBTU : base of 1 ± 0.25 : 1 ± 0.25 : 1 ± 0.25 : 1 to 4.
- 15    The starting compound of formula I-3 may be obtained by methods known to the skilled man. Thus, biaryl compounds are obtained using Suzuki coupling, for example starting from p-bromoarylcarboxylic acid derivatives and arylboric acid derivatives in the presence of Pd[0] catalysts.
- 20    The method of preparation according to the invention for the second group of preferred embodiments, i.e. those compounds wherein the group A and the group R<sup>3</sup> are joined together, distinguishes between seven cases, depending on the meanings IIIa to IIIg of the group Q.
- 25    According to the first case, in which Q denotes -CR<sup>6</sup>R<sup>7</sup>- (IIIa), an amine compound of formula Ia.1 is reacted with an o-bromomethyl-benzoic acid ester derivative of formula Ia.2, as shown in the following reaction plan 4, in which in the interests of clarity the substituents L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> on the phenyl ring have been omitted.

## Reaction plan 4:

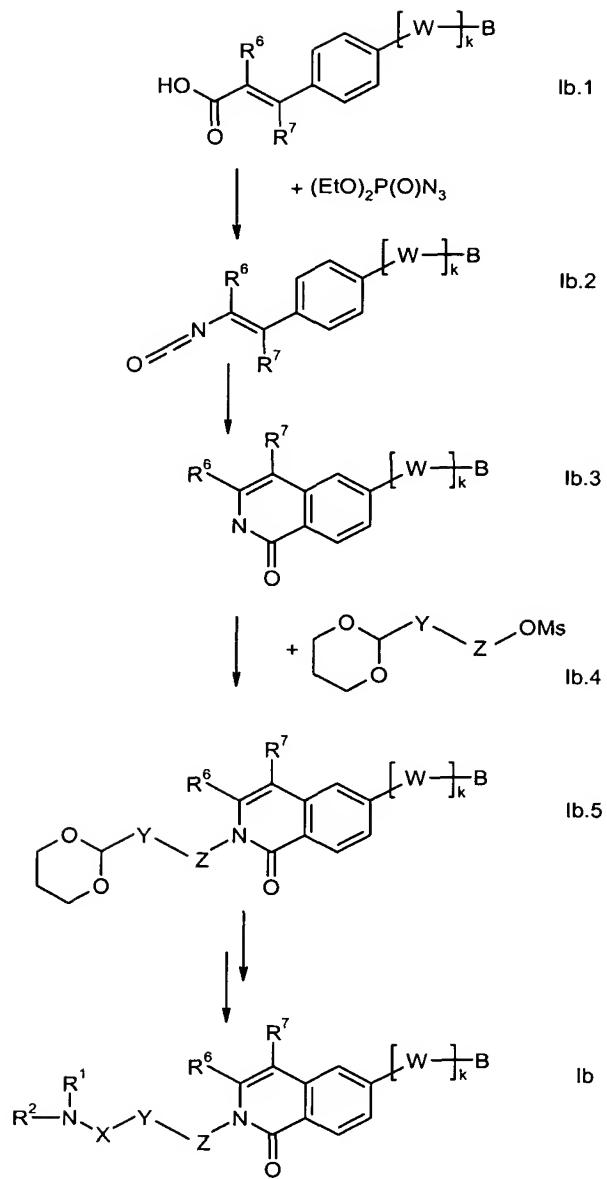


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- Preferably the o-bromomethyl-benzoic acid ester derivative of formula Ia.2 is reacted with the amine compound of formula Ia.1 in a solvent or mixture of solvents, while at least one base is added. Instead of an o-bromomethyl-benzoic acid ester derivative of formula Ia.2 other corresponding o-benzyl-benzoic acid ester derivatives (iodine or mesylate instead of bromine) may also be used.
- Preferably potassium carbonate or caesium carbonate is used as base, but tert. amine bases such as triethylamine are also common. Advantageously the o-bromomethyl-benzoic acid ester derivative of formula Ia.2 is used in acetonitrile with the amine of formula Ia.1 and with potassium carbonate as base in a temperature range of 40-80°C in a molar ratio of the o-bromomethyl-benzoic acid ester derivative of formula Ia.2 : amine of formula Ia.1 : potassium carbonate of  $1\pm 0.25 : 1\pm 0.25 : 3\pm 0.50$ .

According to the second case, in which Q denotes -CR<sup>6</sup>=R<sup>7</sup>- (IIlb), an isoquinolinone derivative of formula Ib.3 is reacted with an electrophilic compound of formula Ib.4 to form an isoquinoline derivative of formula Ib.5, which is further derivatised by known methods to obtain the compound of formula I. The  
5 isoquinolinone derivative of formula Ib.3 is obtainable from cinnamic acid derivatives of formula Ib.1 by reaction with (EtO)<sub>2</sub>P(O)N<sub>3</sub>. The synthesis of the base substance was described by M. Becker et al. in Bioorganic & Medicinal Chemistry Letters 9 (1999), 2753-2758. The reaction is illustrated in the following reaction plan 5, in which in the interests of clarity the substituents L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> on the  
10 phenyl ring have been omitted.

Reaction plan 5:



A compound of formula Ib.2 is advantageously obtained by the reaction sequence described hereinafter. The acrylic acid derivative Ib.1 is first reacted by the action of chlorinating agents such as thionyl chloride, phosphorus pentachloride or oxalyl chloride without or optionally in an inert solvent such as dichloromethane to obtain the acid chloride at temperatures between 0 °C and 80 °C. This is converted by  
5

the action of sodium azide in a solvent or mixture of solvents into the acrylic acid azide derivative. The solvents used may be for example dioxane, tetrahydrofuran or water. Preferably the isocyanate derivative Ib.2 is synthesised directly by the action of phosphoric acid diphenylester azide on the acrylic acid derivative Ib.1 in  
5 the presence of a base in a solvent at temperatures between 0°C and 150°C . Suitable solvents include for example toluene or dioxane. Tertiary amines such as for example triethylamine may be used as bases. The above reactions have reaction times of between one and twelve hours. Advantageously the reaction of the acrylic acid derivative Ib.1 with phosphoric acid diphenylester azide and  
10 triethylamine in a molar ratio of  $1\pm 0.25 : 1\pm 0.25 : 1\pm 0.25$  takes place in toluene as solvent.

The isocyanate derivative Ib.2 is heated in a solvent optionally in the presence of a base such as for example tributylamine and forms the isoquinolone derivative of  
15 formula Ib.3. Preferably the reaction takes place in diphenylether in the region of the melting point. Heat sources which may be used are oil, metal baths or a microwave.

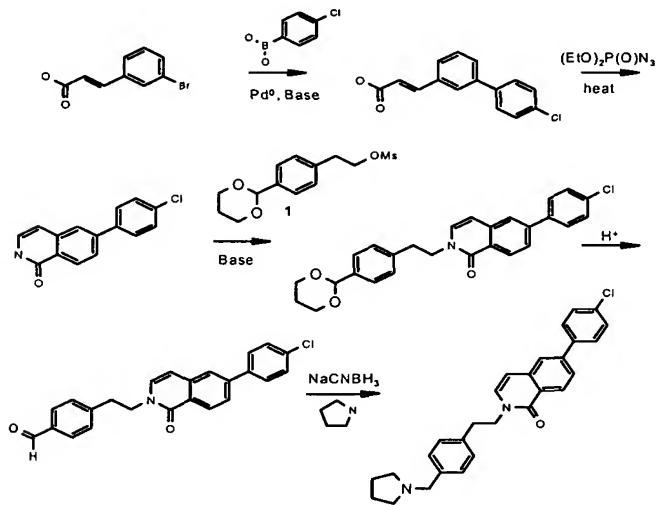
The reaction of the isoquinolone derivative of formula Ib.3 with the mesylate  
20 derivative of formula Ib.4 to form the isoquinolone derivative of formula Ib.5 is carried out in a solvent in the presence of a base at temperatures between 0°C and 150°C. Advantageously the reaction of the isoquinolone derivative Ib.3 with the mesylate derivative of formula Ib.4 and sodium hydride in a molar ratio of  $1\pm 0.25 : 1\pm 0.25 : 1\pm 0.25$  takes place in DMF as solvent.  
25 The isoquinolone derivative of formula Ib.5 is first reacted in a solvent in the presence of an acid, in order to convert the acetal into the corresponding aldehyde. This is converted into a compound of formula Ib in the presence of a hybrid converter, an amine and an acid in a solvent. Examples of hybrid converters include for example sodium triacetoxyborohydride, sodium borohydride  
30 and sodium cyanoborohydride. Advantageously the reaction of the aldehydes, liberated from the isoquinolone derivative Ib.5, with an amine and sodium

cyanoborohydride in a molar ratio of  $1\pm0.25 : 1\pm0.25 : 0.8\pm0.25$  takes place in methanol and acetic acid at temperatures of around  $20^{\circ}\text{C}$ .

The synthesis of isoquinolines of formula Ib, including the starting compounds and

- 5 subsequent derivatisation to form the amine, will be illustrated by means of the following plan of synthesis of a specific compound, while the synthesis of the educt 1 can be inferred from the following Diagram 6 , in order to prepare phthalazinones (Diagram 8).

10 Reaction plan 6:

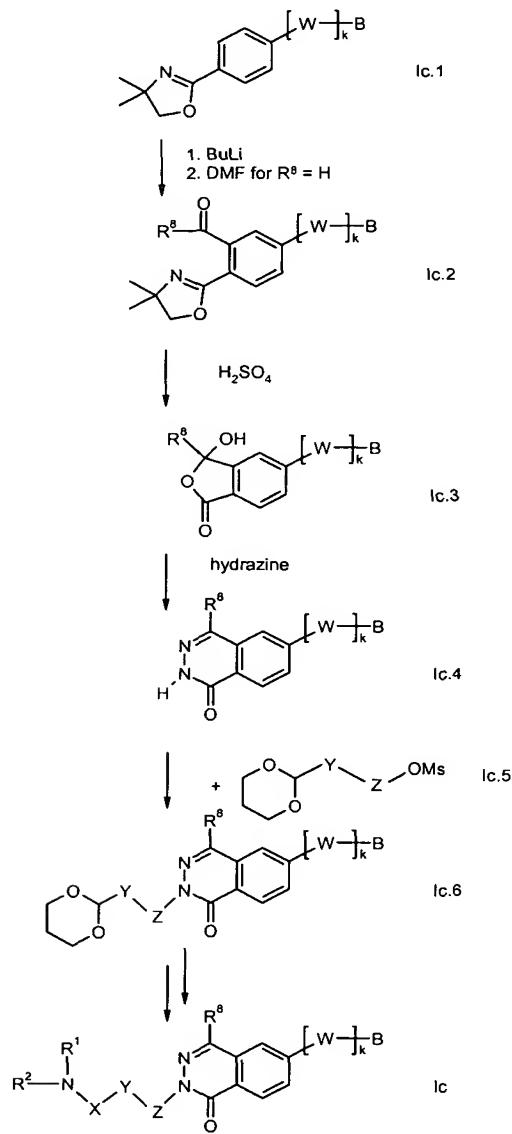


According to the third case in which Q denotes  $\text{-N=CR}^8-$  (IIIC), a phthalazinone derivative of formula Ic.4 is reacted with an electrophilic compound of formula Ic.5

- 15 to form a phthalazinone derivative of formula Ic.6, which is further derivatised by known methods to form the compound of formula Ic. The phthalazinone derivative of formula Ic.4 for  $\text{R}^8=\text{hydrogen}$  is obtainable starting from the phenyloxazole derivative of formula Ic.1 by acylation to form an o-oxazolyl-benzaldehyde derivative of formula Ic.2 and subsequent cyclisation to form a 3-hydroxy-3H-isobenzofuran-1-one derivative of formula Ic.3. The synthesis of the base substance was described by M. Napoletano et al., Bioorganic & Medicinal

Chemistry Letters 12 (2002), 5-8. The reaction to form compounds of general formula Ic is illustrated in the following reaction plan 7, in which in the interests of clarity the substituents L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> on the phenyl ring have been omitted.

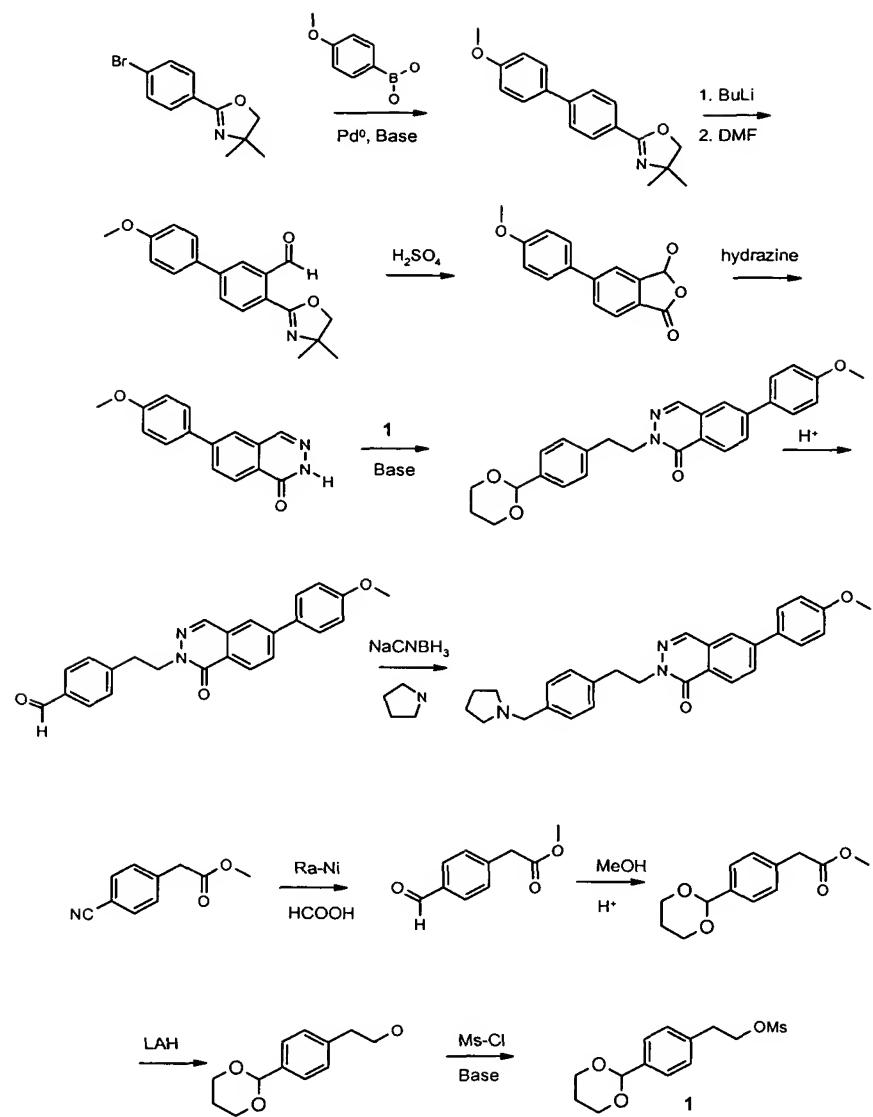
5 Reaction plan 7:



The above reaction sequence is described in more detail hereinafter: The oxazoline derivative Ic.1 is metallised using a suitable organometallic reagent and then reacted with a formaldehyde equivalent such as for example dimethylformamide or an orthoformate at temperatures between -70 °C and 20 °C, 5 preferably at temperatures between -20 °C and 0 °C, to form a compound of formula Ic.2. Suitable solvents include for example dioxane, tetrahydrofuran or diethyl ether. By the action of aqueous sulphuric acid in a solvent such as for example ethanol at a temperature close to the boiling point of the solvent or mixture of solvents over a period of one to 24 hours, a compound of general 10 formula Ic.3 may be obtained. The phthalazinone derivative of formula Ic.4 may be obtained by reacting a compound of formula Ic.3 with hydrazine in acetic acid and optionally in a solvent at temperatures in range between 20 and 120 degrees celsius. The synthesis to obtain the phthalazinone derivative of formula Ic is carried out analogously to the reactions as described for the synthesis of a 15 compound of general formula Ib.

The synthesis of phthalazinone derivatives of formula Ic, particularly the starting compounds and the subsequent derivatisation, will now be illustrated with reference to a plan of synthesis 8 of a specific compound in which the 20 abbreviations have the following meanings: LAH denotes lithium aluminium hydride, BuLi denotes n-butyllithium, DMF denotes dimethylformamide, MeOH is methanol and Ms-Cl is methanesulphonic acid chloride.

Reaction plan 8



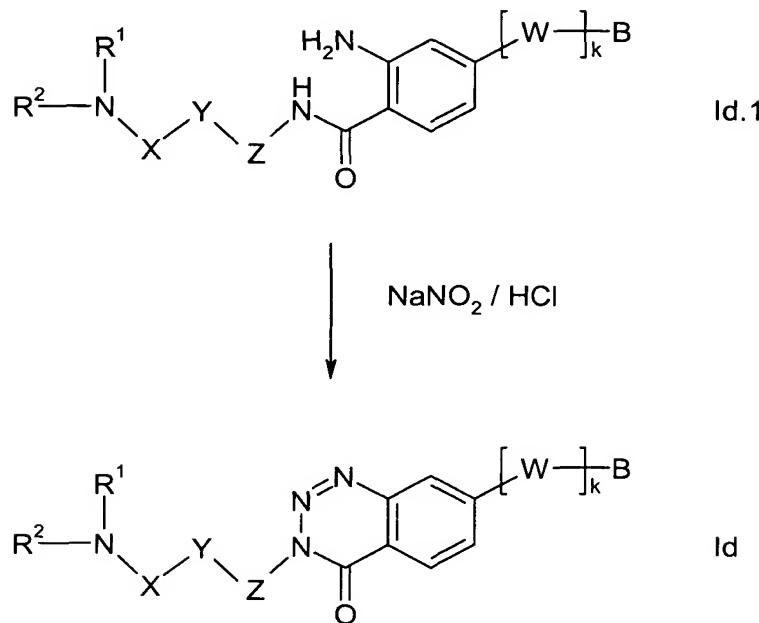
According to the fourth case, in which Q denotes  $-\text{N}=\text{N}-$  (IIId), an o-amino-benzamide derivative of formula Id.1 is reacted in the presence of a suitable nitrite compound and an acid via a diazonium intermediate to form a benzotriazinone derivative of formula Id. The reaction is illustrated in the following reaction plan 9,

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in which in the interests of clarity the substituents L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> on the phenyl ring have been omitted.

## Reaction plan 9:

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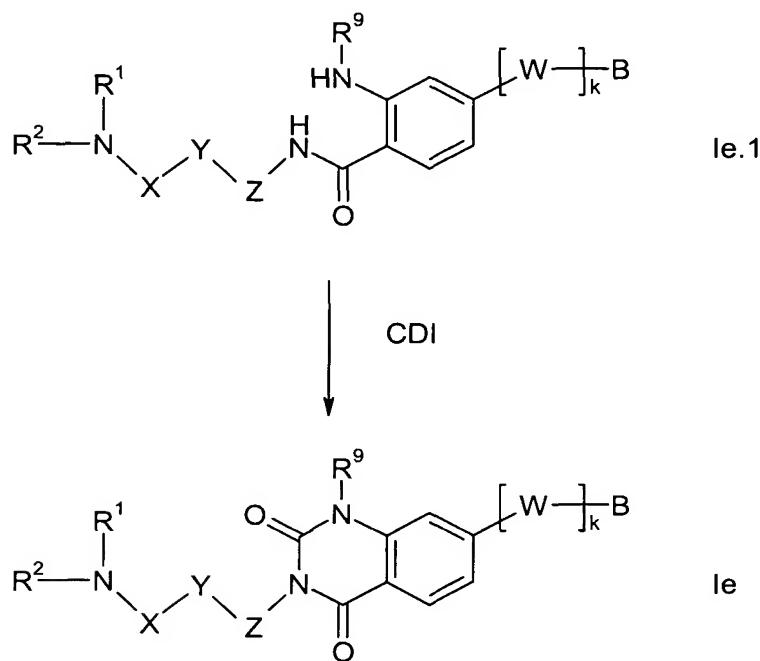
Preferably a compound of general formula Id.1 is reacted in a solvent such as for example methanol in the presence of an inorganic acid, for example hydrochloric acid, and a salt containing the nitrite ion at a temperature between -10 °C and 30 °C. Advantageously the reaction of the amino compound Id.1 with sodium nitrite in a molar ratio of 1±0.25 : 1,5±0.25 takes place in methanol as solvent and in the presence of hydrochloric acid.

10 According to the fifth case, in which Q denotes -CO-NR<sup>9</sup>- (IIe), an o-amino-benzamide derivative of formula Ie.1 is reacted in the presence of CDI to form a quinazolininedione derivative of formula Ie. CDI is added to the benzamide derivative of formula Ie.1 in a molar ratio of greater than or equal to 1 and the

reaction is carried out at least partially in a temperature range of 35°C to 100°C, preferably in the region of the boiling temperature of the reaction mixture. The reaction is illustrated in the following reaction plan 10, in which in the interests of clarity the substituents L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> on the phenyl ring have been omitted.

5

Reaction plan 10:

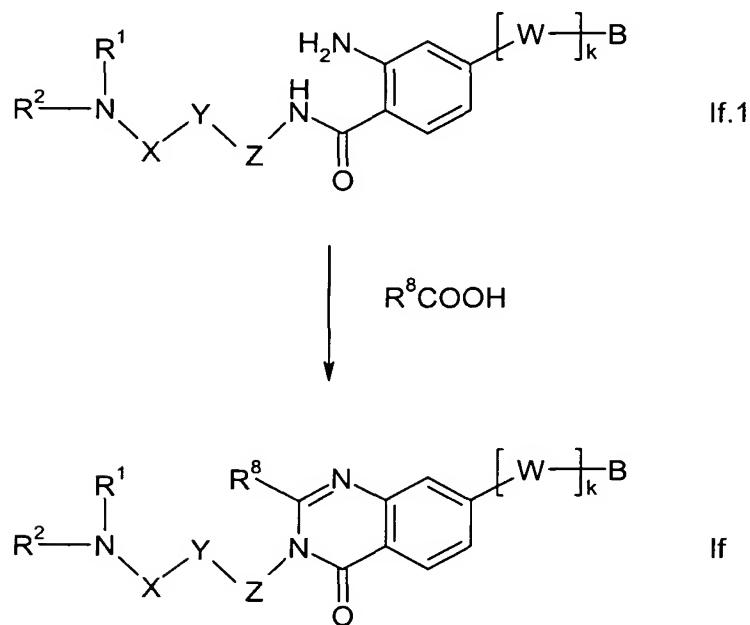


- 10 According to the sixth case, in which Q denotes -CR<sup>8</sup>=N- (IIIf), an o-amino-benzamide derivative of formula If.1 is reacted with a carboxylic acid R<sup>8</sup>COOH and/or a corresponding activated carboxylic acid derivative to form the quinazolinone derivative of formula If. Suitable activated carboxylic acid derivatives are for example esters, ortho-esters, carboxylic acid chlorides and anhydrides. The optionally activated carboxylic acid is added to the carboxamide compound of formula If.1 in a molar ratio of greater than or equal to 1 and the reaction is at least partially carried out in a temperature range of 35°C to 100°C, preferably in the region of the boiling temperature of the reaction mixture. The
- 15

reaction is illustrated in the following reaction plan 11, in which in the interests of clarity the substituents L<sup>1</sup>, L<sup>2</sup>, L<sup>3</sup> on the phenyl ring have been omitted.

Reaction plan 11:

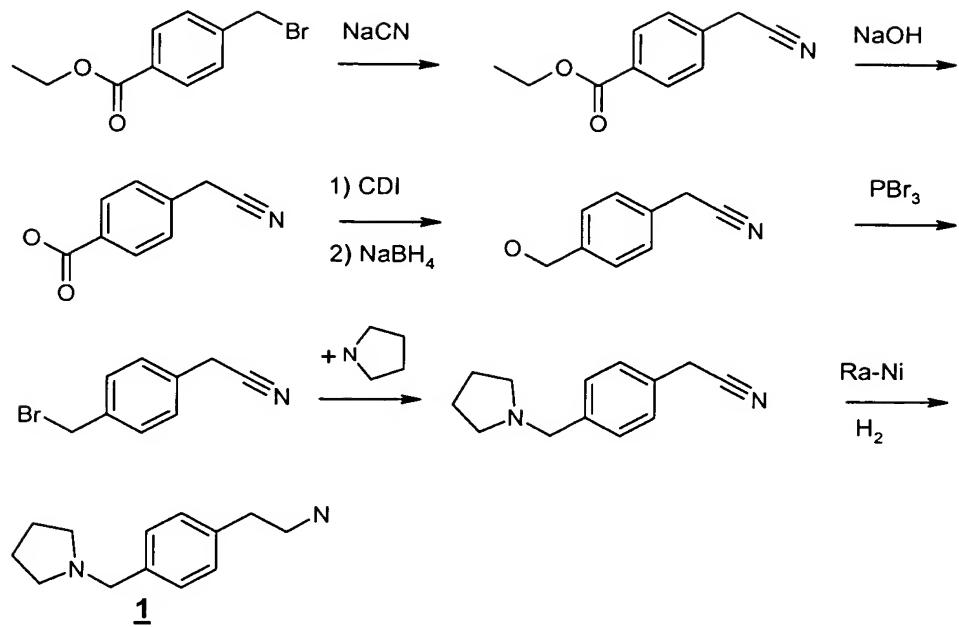
5



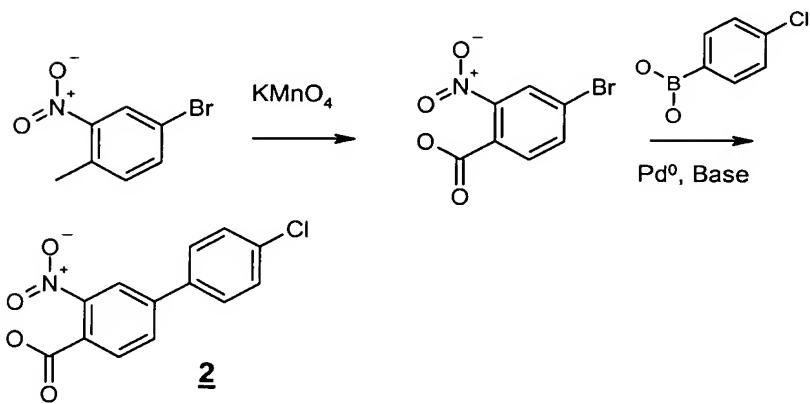
The synthesis of quinazolinone derivatives of formula If, particularly the starting compounds, will be illustrated with reference to a plan of synthesis 12 of a specific compound, in which the following abbreviations are used : CDI for carbonyldiimidazole, TBTU for 2-(1H-benzotriazol-1-yl)-1,1,3,3-tetramethyluronium-tetrafluoroborate and NEt<sub>3</sub> for triethylamine. First the synthesis plans for the two starting compounds 1 and 2 are shown.

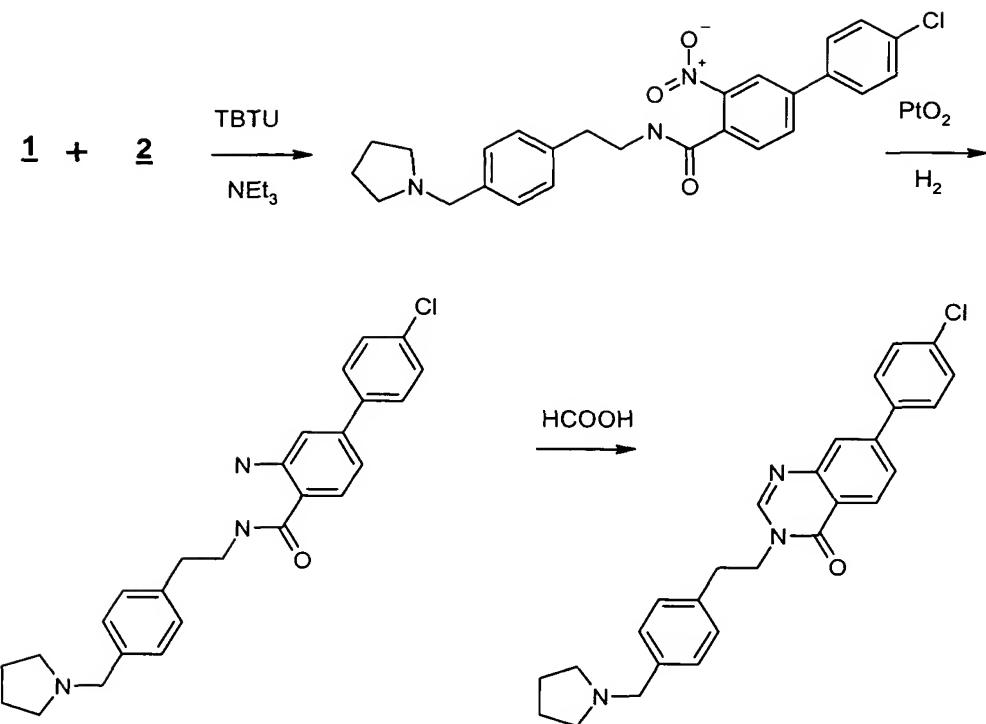
10

Reaction plan 12



5

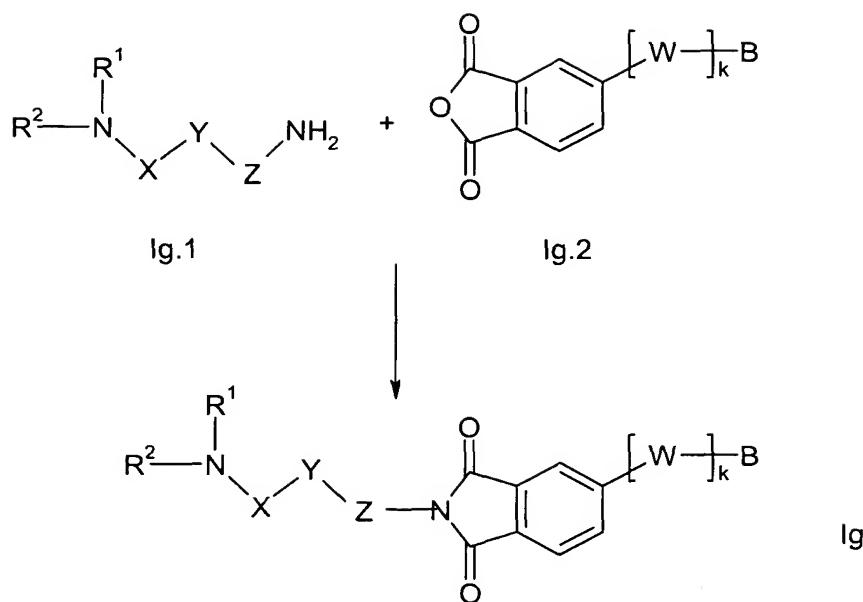




The starting compounds 1 and 2 are linked together via an amide link using TBTU. The nitro group in the ortho position to the amide bond obtained is reduced to form  
 5 the amine in the presence of  $\text{PtO}_2$ . Cyclisation to form the quinazolinone is carried out using a carboxylic acid, in this case formic acid.

According to the seventh case in which Q denotes  $-\text{CO}-$  (IIIg), an  
 10 isobenzofurandione derivative of formula Ig.2 is reacted with an amine compound of formula Ig.1 to form the isoindoldione derivative of formula Ig. The reaction is illustrated in the following reaction plan 13, in which in the interests of clarity the substituents  $\text{L}^1$ ,  $\text{L}^2$ ,  $\text{L}^3$  on the phenyl ring have been omitted.

Reaction plan 13:

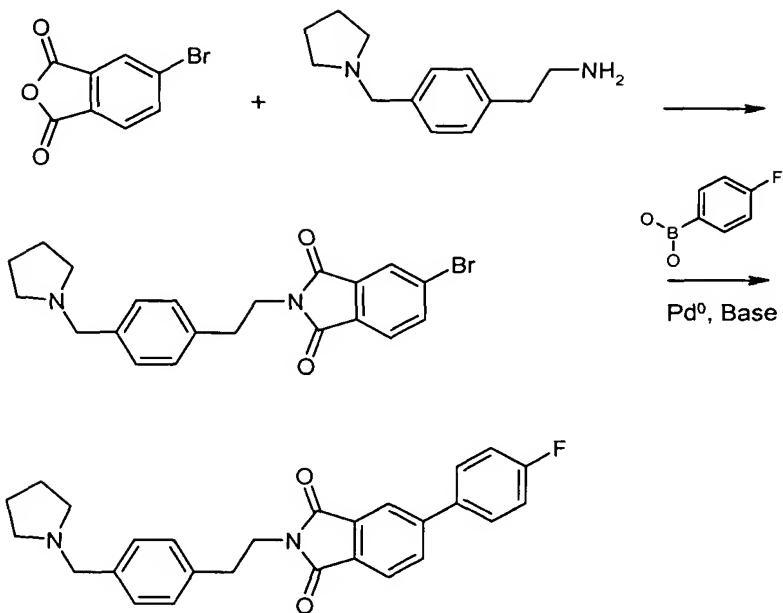


The isobenzofurandione derivative Ig.2 is reacted in a solvent such as for example acetic acid with an amine of general formula Ig.1 in a molar ratio of  $1\pm 0.25 : 5\pm 0.25$ . The temperature during the reaction is preferably the boiling temperature of the solvent.

The isoindoldione derivative of formula Ig may however also be obtained according to the following synthesis plan 14. The synthesis of an individual compound as shown can readily be applied to other compounds of formula Ig, optionally modified, by anyone skilled in the art. First of all, the isoindoldione function is obtained from an isobenzofurandione derivative, binding an amine, and then a further aryl group is added by Suzuki coupling in the presence of Pd[0].

15

Reaction plan 14



- 5 The possible methods described above for synthesising the compounds according to the invention may readily be modified and/or supplemented at least in their broad outline by the skilled man using known methods as described for example in Houben-Weyl, Methoden der organischen Chemie, with regard to the individual compounds which are to be synthesised.
- 10 In the reactions described above, any reactive groups present such as hydroxy, carboxy, amino or imino groups may be protected during the reaction by methods known from the literature by conventional protecting groups which are cleaved again after the reaction; the protecting groups conventionally used in peptide chemistry may be used, in particular. Information on this may be found in WO 98/11128 for example.
- 15 Stereoisomeric compounds of formula (I) may be separated in principle by conventional methods. The diastereomers may be separated on the basis of their

different physico-chemical properties, e.g. by fractional crystallisation from suitable solvents, by high pressure liquid or column chromatography, using chiral or preferably non-chiral stationary phases.

- 5 As already mentioned, the compounds of formula (I) may be converted into the salts thereof, particularly for pharmaceutical use into the physiologically and pharmacologically acceptable salts thereof. These salts may be present on the one hand as physiologically and pharmacologically acceptable acid addition salts of the compounds of formula (I) with inorganic or organic acids. On the other hand,
- 10 in the case of acidically bound hydrogen, the compound of formula (I) may also be converted by reaction with inorganic bases into physiologically and pharmacologically acceptable salts with alkali or alkaline earth metal cations as counter-ion. The acid addition salts may be prepared, for example, using hydrochloric acid, hydrobromic acid, sulphuric acid, phosphoric acid,
- 15 methanesulphonic acid, acetic acid, fumaric acid, succinic acid, lactic acid, citric acid, tartaric acid or maleic acid. Moreover, mixtures of the above mentioned acids may be used. To prepare the alkali and alkaline earth metal salts of the compound of formula (I) with acidically bound hydrogen the alkali and alkaline earth metal hydroxides and hydrides are preferably used, while the hydroxides and hydrides of the alkali metals, particularly sodium and potassium are preferred and sodium and potassium hydroxide are most preferred.
- 20

The compounds according to the present invention, including the physiologically acceptable salts, are effective as antagonists of the MCH receptor, particularly the MCH-1 receptor, and exhibit good affinity in MCH receptor binding studies. Pharmacological test systems for MCH-antagonistic properties are described in the following experimental section.

As antagonists of the MCH receptor the compounds according to the invention are advantageously suitable as pharmaceutical active substances for the prevention and/or treatment of symptoms and/or diseases caused by MCH or

causally connected with MCH in some other way. Generally the compounds according to the invention have low toxicity, they are well absorbed by oral route and have an intracerebral transitivity, particularly brain accessibility.

- 5 Therefore, MCH antagonists which contain at least one compound according to the invention, are particularly suitable in mammals, such as for example rats, mice, guinea pigs, hares, dogs, cats, sheep, horses, pigs, cattle, monkeys and also humans, for the treatment and/or prevention of symptoms and/or diseases which are caused by MCH or are otherwise causally connected with MCH.

10

Diseases caused by MCH or otherwise causally connected with MCH are particularly metabolic disorders, such as for example obesity, and eating disorders, such as for example bulimia, including bulimia nervosa. The indication obesity includes in particular exogenic obesity, hyperinsulinaemic obesity,

- 15 hyperplasmic obesity, hyperphyseal adiposity, hypoplasmic obesity, hypothyroid obesity, hypothalamic obesity, symptomatic obesity, infantile obesity, upper body obesity, alimentary obesity, hypogonadal obesity, central obesity. This range of indications also includes cachexia, anorexia and hyperphagia. Compounds according to the invention may be particularly suitable for reducing hunger, reining 20 in appetite, controlling eating behaviour and/or inducing a feeling of satiation.

- In addition, the diseases caused by MCH or otherwise causally connected with MCH also include hyperlipidaemia, cellulitis, fatty accumulation, malignant mastocytosis, systemic mastocytosis, emotional disorders, affectivity disorders, 25 depression, anxiety states, reproductive disorders, memory disorders, forms of dementia and hormonal disorders.

- Compounds according to the invention are also suitable as active substances for the prevention and/or treatment of other illnesses and/or disorders, particularly 30 those which accompany obesity, such as for example diabetes, diabetes mellitus, particularly type II diabetes, hyperglycaemia, particularly chronic hyperglycaemia,

complications of diabetes including diabetic retinopathy, diabetic neuropathy, diabetic nephropathy, etc., insulin resistance, pathological glucose tolerance, cardiovascular diseases, particularly arteriosclerosis and high blood pressure, and gonitis.

5

MCH antagonists and formulations according to the invention may advantageously be used in combination with a dietary therapy, such as for example a dietary diabetes treatment, and exercise.

10 Another range of indications for which the compounds according to the invention are advantageously suitable is the prevention and/or treatment of micturition disorders, such as for example urinary incontinence, hyperactive bladder, nocturia, enuresis, while the hyperactive bladder and urinary incontinence may or may not be connected with benign prostatic hyperplasia.

15

The dosage required to achieve such an effect is conveniently, by intravenous or subcutaneous route, 0.001 to 30 mg/kg of body weight, preferably 0.01 to 5 mg/kg of body weight, and by oral or nasal route or by inhalation, 0.01 to 50 mg/kg of body weight, preferably 0.1 to 30 mg/kg of body weight, in each case 1 to 3 x daily.

20

For this purpose, the compounds of formula I prepared according to the invention may be formulated, optionally together with other active substances as described hereinafter, together with one or more physiologically acceptable excipients, inert conventional carriers and/or diluents, e.g. with corn starch, lactose, glucose,

25 microcrystalline cellulose, magnesium stearate, polyvinylpyrrolidone, citric acid, tartaric acid, water, water/ethanol, water/glycerol, water/sorbitol, water/polyethylene glycol, propylene glycol, cetylstearyl alcohol, carboxymethylcellulose or fatty substances such as hard fat or suitable mixtures thereof, to produce conventional galenic preparations such as plain or coated  
30 tablets, capsules, powders, granules, solutions, emulsions, syrups, aerosols for inhalation, ointments or suppositories.

In addition to pharmaceutical compositions the invention also includes compositions containing at least one carboxamide compound according to the invention and/ or a salt according to the invention optionally together with one or 5 more physiologically acceptable excipients. Such compositions may also be for example foodstuffs which may be solid or liquid, in which the compound according to the invention is incorporated.

For the above mentioned combinations it is possible to use as additional active 10 substances particularly those which for example potentiate the therapeutic effect of an MCH antagonist according to the invention in terms of one of the indications mentioned above and/or which make it possible to reduce the dosage of an MCH antagonist according to the invention. Preferably one or more additional active substances are selected from among

- 15 - active substances for the treatment of diabetes,
- active substances for the treatment of diabetic complications,
- active substances for the treatment of obesity, preferably other than MCH antagonists,
- active substances for the treatment of high blood pressure,
- 20 - active substances for the treatment of hyperlipidaemia, including arteriosclerosis,
- active substances for the treatment of arthritis,
- active substances for the treatment of anxiety states,
- active substances for the treatment of depression.

25

The above mentioned categories of active substances will now be explained in more detail by means of examples.

Examples of active substances for the treatment of diabetes are insulin 30 sensitizers, insulin secretion accelerators, biguanides, insulins,  $\alpha$ -glucosidase inhibitors,  $\beta$ 3 adreno-receptor agonists.

5           Insulin sensitizers include pioglitazone and its salts (preferably hydrochloride), troglitazone, rosiglitazone and its salts (preferably maleate), JTT-501, GI-262570, MCC-555, YM-440, DRF-2593, BM-13-1258, KRP-297, R-119702, GW-1929.

10          Insulin secretion accelerators include sulphonylureas, such as for example tolbutamide, chloropropamide, trazamide, acetohexamide, glydlopyramide and its ammonium salts, glibenclamide, gliclazide, glimepiride. Further examples of insulin secretion accelerators are repaglinide, nateglinide, mitiglinide (KAD-1229) and JTT-608.

Biguanides include metformin, buformin and phenformin.

15          Insulins include those obtained from animals, particularly cattle or pigs, semisynthetic human insulins which are synthesised enzymatically from insulin obtained from animals, human insulin obtained by genetic engineering, e.g. from Escherichia coli or yeasts. Moreover, the term insulin also includes insulin-zinc (containing 0.45 to 0.9 percent by weight of zinc) and protamine-insulin-zinc obtainable from zinc chloride, protamine sulphate and insulin. Insulation may also be obtained from insulin fragments or derivatives (for example INS-1, etc.).

20          Insulin may also include different kinds, e.g. with regard to the onset time and duration of effect ("ultra immediate action type", "immediate action type", "two phase type", "intermediate type", "prolonged action type", etc.), which are selected depending on the pathological condition of the patient.

25           $\alpha$ -Glucosidase inhibitors include acarbose, voglibose, miglitol, emiglitatate.

30

β<sub>3</sub> Adreno receptor agonists include AJ-9677, BMS-196085, SB-226552, AZ40140.

5 Active substances for the treatment of diabetes other than those mentioned above include ergoset, pramlintide, leptin, BAY-27-9955 as well as glycogen phosphorylase inhibitors, sorbitol dehydrogenase inhibitors, protein tyrosine phosphatase 1B inhibitors, dipeptidyl protease inhibitors, glipizide, glyburide.

10 Active substances for the treatment of diabetic complications include for example aldose reductase inhibitors, glycation inhibitors and protein kinase C inhibitors.

Aldose reductase inhibitors are for example tolrestat, epalrestat, imirestat, zenarestat, SNK-860, zopolrestat, ARI-50i, AS-3201.

15 An example of a glycation inhibitor is pimagedine.

Protein Kinase C inhibitors are for example NGF, LY-333531.

20 Active substances other than those mentioned above for the treatment of diabetic complications include alprostadil, thiapride hydrochloride, cilostazol, mexiletine hydrochloride, ethyl eicosapentate, memantine, pimagedine (ALT-711).

25 Active substances for the treatment of obesity, preferably other than MCH antagonists, include lipase inhibitors and anorectics.

A preferred example of a lipase inhibitor is orlistat.

30 Examples of preferred anorectics are phentermine, mazindol, dextroamphetamine, fluoxetine, sibutramine, bupropion, (S)-sibutramine, SR-141716, NGD-95-1.

Active substances other than those mentioned above for the treatment of obesity include lipstatin.

- Moreover for the purposes of this application the active substance group of anti-obesity active substances also includes the anorectics, of which the  $\beta_3$  agonists, thyromimetic active substances and NPY antagonists should be emphasised. The scope of the anti-obesity/anorectic active substances which are preferred here is indicated by the following additional list, by way of example: phenylpropanolamine, ephedrine, pseudoephedrine, phentermine, a cholecystokinin-A (hereinafter referred to as CCK-A) agonist, a monoamine reuptake inhibitor (such as for example sibutramine), a sympathomimetic active substance, a serotonergic active substance (such as for example dexfenfluramine or fenfluramine), a dopamine antagonist (such as for example bromocriptine), a melanocyte-stimulating hormone receptor agonist or mimetic, an analogue of melanocyte-stimulating hormone, a cannabinoid receptor antagonist, an MCH antagonist, the OB protein (hereinafter referred to as leptin), a leptin analogue, a leptin receptor agonist, a galanine antagonist, a GI lipase inhibitor or reducer (such as for example orlistat). Other anorectics include bombesin agonists, dehydroepiandrosterone or its analogues, glucocorticoid receptor agonists and antagonists, orexin receptor antagonists, urocortin binding protein antagonists, agonists of the Glucagon-like Peptide-1 receptor, such as for example exendin and ciliary neurotrophic factors, such as for example axokines.
- Active substances for the treatment of high blood pressure include inhibitors of angiotensin converting enzyme, calcium antagonists, potassium channel openers and angiotensin II antagonists.
- inhibitors of angiotensin converting enzyme include captopril, enalapril, alacepril, delapril (hydrochloride), lisinopril, imidapril, benazepril, cilazapril, temocapril, trandolapril, manidipine (hydrochloride).

Examples of calcium antagonists are nifedipine, amlodipine, efonidipine, nicardipine.

- 5 Potassium channel openers include levcromakalim, L-27152, AL0671, NIP-121.

Angiotensin II antagonists include telmisartan, losartan, candesartan cilexetil, valsartan, irbeartan, CS-866, E4177.

- 10 Active substances for the treatment of hyperlipidaemia, including arteriosclerosis, include HMG-CoA reductase inhibitors, fibrate compounds.

- 15 HMG-CoA reductase inhibitors include pravastatin, simvastatin, lovastatin, atorvastatin, fluvastatin, lipantil, cerivastatin, itavastatin, ZD-4522 and their salts.

- Fibrate compounds include bezafibrate, clinofibrate, clofibrate and simfibrate.
- 20 Active substances for the treatment of arthritis include ibuprofen.

Active substances for the treatment of anxiety states include chlordiazepoxide, diazepam, oxazepam, medazepam, cloxazolam, bromazepam, lorazepam, alprazolam, fludiazepam.

- 25 Active substances for the treatment of depression include fluoxetine, fluvoxamine, imipramine, paroxetine, sertraline.

- 30 The dosage for these active substances is conveniently 1/5 of the lowest normal recommended dose up to 1/1 of the normal recommended dose.

In another embodiment the invention also relates to the use of at least one carboxamide compound according to the invention and/or a salt according to the invention for influencing the eating behaviour of a mammal. This use is particularly based on the fact that compounds according to the invention may be suitable for

5 reducing hunger, restricting appetite, controlling eating behaviour and/or inducing a feeling of satiety. The eating behaviour is advantageously influenced so as to reduce food intake. Therefore, compounds according to the invention are advantageously used for reducing body weight. Another use according to the invention is the prevention of increases in body weight, for example in people who

10 had previously taken steps to lose weight and are interested in maintaining their lower body weight. According to this embodiment it is preferably a non-therapeutic use. Such a non-therapeutic use might be a cosmetic use, for example to alter the external appearance, or an application to improve general health. The compounds according to the invention are preferably used non-therapeutically for mammals,

15 particularly humans, not suffering from any diagnosed eating disorders, no diagnosed obesity, bulimia, diabetes and/or no diagnosed micturition disorders, particularly urinary incontinence. Preferably, the compounds according to the invention are suitable for non-therapeutic use in people whose BMI (body mass index), defined as their body weight in kilograms divided by their height (in metres) squared, is below a level of 30, particularly below 25.

20

The Examples that follow are intended to illustrate the invention:

Preliminary remarks:

25 As a rule, melting points,  $^1\text{H-NMR}$  and/or mass spectra have been obtained for the compounds prepared. Unless otherwise stated the  $R_f$  values were determined using ready-made silica gel 60 TLC plates F<sub>254</sub> (E. Merck, Darmstadt, Item no. 1.05714) without chamber saturation. The  $R_f$  values obtained under the heading Alox were determined using ready-made aluminium oxide 60 TLC plates F<sub>254</sub> (E. Merck, Darmstadt, Item no. 1.05713) without chamber saturation.

30

The HPLC data specified were measured under the parameters indicated below:  
Zorbax column (Agilent Technologies), SB (Stable Bond) - C18; 3.5 µm; 4.6 x 75 mm; column temperature: 30°C; flow: 0.8 mL / min; injection volume: 5 µL; detection at 254 nm.

- 5    Method A: water:acetonitrile:formic acid 9:1:0.01 towards 1:9:0.01 over 9 min  
Method B: water:acetonitrile:formic acid 9:1:0.01 towards 1:9:0.01 over 4 min, then 6 min 1:9:0.01

If there is no specific information as to the configuration, it is not clear whether there are pure enantiomers or whether partial or even total racemisation has taken 10 place.

The following abbreviations are used above and hereinafter:

|                      |   |
|----------------------|---|
| BOC-anhydride        | tert.-butyloxycarbonyl-anhydride                                      |
| CDI                  | carbonyldiimidazole   |
| CDT                  | 1,1'-carbonyldi-(1,2,4-triazole)                                      |
| DMF                  | dimethylformamide   |
| ethyl acetate/ EtOAc | ethyl acetate   |
| ether                | diethyl ether   |
| HOBr                 | 1-hydroxybenzotriazole-hydrate  |
| Hünig base           | N,N-diisopropyl-ethylamine  |
| conc.                | concentrated  |
| Me                   | methyl  |
| MeOH                 | methanol  |
| RT                   | room temperature (approx. 20°C)                                       |
| TBTU                 | 2-(1H-benzotriazol-1-yl)-1,1,3,3-tetramethyluronium-tetrafluoroborate |
| THF                  | tetrahydrofuran   |
| eq.                  | equivalent  |
| calc.                | calculated  |
| fdn.                 | found   |

**General working method I (TBTU coupling):**

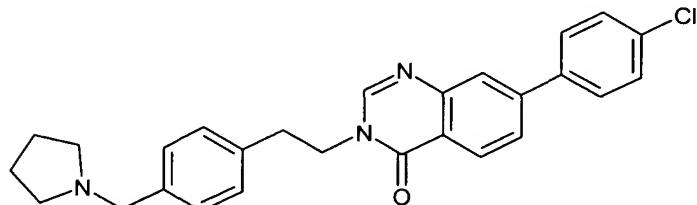
Triethylamine (1.5 eq.) and TBTU (1.0 eq.) are added successively to a solution of carboxylic acid (1.0 eq.) in THF or DMF. Depending on the carboxylic acid the mixture is stirred for 10 min to 12 h between ambient temperature and 40°C before the amine (1.0 eq.) is added. The reaction is stirred for 30 min to 2 h between ambient temperature and 40°C, before semisaturated NaHCO<sub>3</sub> solution is added. After extraction of the aqueous phase with a suitable solvent (e.g. ethyl acetate) the organic phase is dried over magnesium sulphate. The solvent is removed using the rotary evaporator; further purification is carried out by column chromatography or HPLC. The reaction may also be carried out in a Chemspeed automatic synthesiser.

**15 General working method II (CDT coupling):**

CDT (1 eq.) is added to a solution of the primary amine (1.0 eq.) in DMF (1 mmol/mL) at 0°C and the mixture is stirred at 0°C for a further 30 min. The reaction is heated to 25°C and triethylamine (3 eq.) is added. Then the secondary amine (1.0 eq.) in DMF (0.25 mmol/mL) is added and the reaction solution is heated to 60 to 80°C for 30 min to 3 h. DMF is removed in vacuo and the residue is taken up with dichloromethane and 5%-Na<sub>2</sub>CO<sub>3</sub> solution or with water and *tert*-butylmethyl ether. The organic phase is extracted with water and the solvent is removed using the rotary evaporator optionally after drying over magnesium sulphate; further purification is carried out by column chromatography or crystallisation. The reaction may also be carried out in a Chemspeed automatic synthesiser.

**Example 1.1:**

7-(4-chloro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one



5

1.1.a. 4-Bromo-2-nitro-benzoic acid

To a reaction mixture of 82 g (0.379 mol) 4-bromo-2-nitro-toluene in 700 ml of pyridine and 500 ml of water are added batchwise 174.5 g (1.104 mol) of potassium permanganate within eight hours. The reaction mixture is stirred for 12 hours at 60°C. Then a further 20 g (0.092 mol) of 4-bromo-2-nitro-toluene, 50 ml of pyridine and 30 g (0.189 mol) of potassium permanganate are added one after another. The reaction mixture is stirred for 12 hours at 60°C, combined with 200 ml of ethanol and refluxed for 30 minutes. Then the reaction mixture is filtered hot and the filtrate is evaporated down in the rotary evaporator. The residue remaining is made alkaline with 10 % sodium hydroxide solution and extracted with diethyl ether. The aqueous phase is separated off and acidified with dilute hydrochloric acid. The crystals formed are filtered off, washed with water, azeotropically dried with tetrahydrofuran and stirred with diisopropylether.

Yield: 37 g (32.8 % of theory)

20 C<sub>7</sub>H<sub>4</sub>BrNO<sub>4</sub> (M= 246.018)

calc.: molar peak (M+Na)<sup>+</sup>: 268/270      fnd.: molar peak (M+Na)<sup>+</sup>: 268/270

R<sub>f</sub> value: 0.46 (silica gel, dichloromethane/methanol/acetic acid 8:2:0.1)

1.1.b. 4'-Chloro-3-nitro-biphenyl-4-carboxylic acid

25 0.288 g (0.25 mmol) of tetrakis-(triphenylphosphine)-palladium, 1.25 g (7.99 mmol) of 4-chloro-phenyl-boric acid in 30 ml of methanol and 2.31 g (21.7 mmol) of sodium carbonate in 14 ml of water are added one after another to a solution of

1.92 g (7.81 mmol) of 4-bromo-2-nitro-benzoic acid in 30 ml dioxane. The reaction mixture is heated to 110°C in a microwave at 300 Watt for one hour. Then the reaction mixture is evaporated down in the rotary evaporator, the residue is taken up in water and adjusted to pH 3 with 1 M hydrochloric acid. The aqueous solution  
5 is extracted with ethyl acetate. The organic phase is dried over sodium sulphate, the solvent is distilled off using the rotary evaporator and the residue is stirred with diisopropylether.

Yield: 2.04 g (93.9 % of theory)

C<sub>13</sub>H<sub>8</sub>CINO<sub>4</sub> (M= 277.666)

10 calc.: molar peak (M-H)<sup>-</sup>: 276 fnd.: molar peak (M-H)<sup>-</sup>: 276

R<sub>f</sub> value: 0.5 (silica gel, dichloromethane/methanol/acetic acid 9:1:0.1)

#### 1.1.c. Ethyl 4-cyanomethyl-benzoate

To a solution of 147.5 g (2.263 mol) of potassium cyanide in 250 ml of hot water is  
15 added dropwise a solution of 500 g (2.057 mol) of ethyl 4-bromomethyl-benzoate in 1000 ml of ethanol. The reaction mixture is refluxed for one hour and stirred for 12 hours at ambient temperature. A further 73.7 g (0.5 mol) of potassium cyanide are added and the mixture is refluxed for two hours. The solid in the reaction  
20 mixture is filtered off and the filtrate is filtered through a mixture of silica gel and activated charcoal. The filtrate obtained is evaporated down and the residue is poured onto 1000 ml of water. The aqueous solution is extracted with *tert*-butylmethylether and the organic phase is extracted three times with water. Then the organic phase is dried over magnesium sulphate and the solvent is distilled off using the rotary evaporator. The purification is carried out by column  
25 chromatography on silica gel (petroleum ether/ ethyl acetate 8:2).

Yield: 164.46 g (42.2 % of theory)

C<sub>11</sub>H<sub>11</sub>NO<sub>2</sub> (M= 189.216)

calc.: molar peak (M+H)<sup>+</sup>: 190 fnd.: molar peak (M+H)<sup>+</sup>: 190

R<sub>f</sub> value: 0.3 (silica gel, petroleum ether/ethyl acetate 8:2)

30

#### 1.1.d. 4-Cyanomethyl-benzoic acid

A solution of 10 g (53 mmol) of ethyl 4-cyanomethyl-benzoate and 2.02 ml of a 1 M sodium hydroxide solution in 100 ml of ethanol is refluxed for one hour. Then the reaction solution is evaporated down and the residue is combined with ice water. Concentrated hydrochloric acid is added dropwise to the reaction solution  
5 until no more precipitate is formed. The precipitate is filtered off, washed twice with water and dried.

Yield: 4.7 g (55 % of theory)

C<sub>9</sub>H<sub>7</sub>NO<sub>2</sub> (M= 161.162)

calc.: molar peak (M-H)<sup>-</sup>: 160      fnd.: molar peak (M-H)<sup>-</sup>: 160

10

1.1.e. (4-hydroxymethyl-phenyl)-acetonitrile

5.17 g (32 mmol) of CDI are added to a solution of 4.7 g (29 mmol) of 4-cyanomethyl-benzoic acid in 250 ml of tetrahydrofuran and stirred until the development of gas has ended. This reaction mixture is added dropwise to a  
15 solution of 3.29 g (87 mmol) of sodium borohydride in 200 ml of water in such a way that the temperature does not exceed 30°C. It is stirred for two hours and the reaction mixture is adjusted to pH 3-4 with potassium hydrogen sulphate solution. Then it is extracted with ethyl acetate, the organic phase is dried over magnesium sulphate and the solvent is separated off using the rotary evaporator.

20 Yield: 2.6 g (60.9 % of theory)

C<sub>9</sub>H<sub>9</sub>NO (M= 147.178)

calc.: molar peak (M-H)<sup>-</sup>: 146

fnd.: molar peak (M-H)<sup>-</sup>: 146

25 1.1.f. (4-bromomethyl-phenyl)-acetonitrile

0.86 ml (9 mmol) of phosphorus tribromide are added dropwise at 0°C to a solution of 2.6 g (17.66 mmol) of (4-hydroxymethyl-phenyl)-acetonitrile in 25 ml *tert*-butylmethylether. After the end of the reaction the reaction mixture is combined with water at ambient temperature, the organic phase is separated off  
30 and extracted successively with sodium hydrogen carbonate solution and water.

The organic phase is dried over magnesium sulphate and the solvent is distilled off using the rotary evaporator.

Yield: 2.9 g (78.1 % of theory)

C<sub>9</sub>H<sub>8</sub>BrN (M= 210.075)

5 calc.: molar peak (M+H)<sup>+</sup>: 209/211      fnd.: molar peak (M+H)<sup>+</sup>: 209/211

1.1.g. (4-Pyrrolidin-1-ylmethyl-phenyl)-acetonitrile

0.446 ml (5.44 mmol) of pyrrolidine and 1.366 g (9.882 mmol) of potassium carbonate are added to 20 ml of dimethylformamide. While stirring 1.038 g (4.941 mmol) of (4-bromomethyl-phenyl)-acetonitrile are added and the mixture is stirred for 12 hours at ambient temperature. The reaction mixture is evaporated down in the rotary evaporator and the residue is extracted with ethyl acetate and water. The organic phase is dried over magnesium sulphate and the solvent is eliminated using the rotary evaporator.

15 Yield: 0.732 g (74 % of theory)

C<sub>13</sub>H<sub>16</sub>N<sub>2</sub> (M= 200.286)

calc.: molar peak (M+H)<sup>+</sup>: 201      fnd.: molar peak (M+H)<sup>+</sup>: 201

R<sub>f</sub> value: 0.5 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

20 1.1.h 2-(4-Pyrrolidin-1-ylmethyl-phenyl)-ethylamine

A reaction mixture of 0.73 g (3.66 mmol) of (4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile and 0.1 g of Raney nickel in 25 ml of methanolic ammonia solution is hydrogenated for 9h at 50°C and 3 bar hydrogen.

Yield: 0.72 g (96.4 % of theory)

25 C<sub>13</sub>H<sub>20</sub>N<sub>2</sub> (M= 204.31)

calc.: molar peak (M+H)<sup>+</sup>: 205      fnd.: molar peak (M+H)<sup>+</sup>: 205

R<sub>f</sub> value: 0.23 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

30 1.1.i. 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

- A solution of 0.4 (1.44 mmol) of 4'-chloro-3-nitro-biphenyl-4-carboxylic acid, 0.29g (1.44 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine, 0.46 g (1.44 mmol) of TBTU, 0,19 g (1.44 mmol) of HOBT and 0.42 ml (3 mmol) of triethylamine in 30 ml of tetrahydrofuran is stirred for 14 hours at ambient temperature. The reaction mixture is evaporated down in the rotary evaporator, extracted with water and ethyl acetate and dried over magnesium sulphate. The purification is carried out by column chromatography on silica gel (eluant: dichloromethane/ methanol/ ammonia= 90:10:1).
- Yield: 0.47 g (70.3 % of theory)
- 10 C<sub>26</sub>H<sub>26</sub>CIN<sub>3</sub>O<sub>3</sub> (M= 463.96)  
calc.: molar peak (M+H)<sup>+</sup>: 464/466      fnd.: molar peak (M+H)<sup>+</sup>: 464/466  
R<sub>f</sub> value: 0.36 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)
- 15 1.1.j. 4'-Chloro-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide  
A reaction mixture of 0.47 g (1.01 mmol) of 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide and 0.1 g of Raney nickel in 50 ml of methanolic ammonia solution is hydrogenated for 24 hours at 20°C and 3 bar hydrogen. The crude product is further reacted without purification.
- 20 Yield: 0.46 g crude  
C<sub>26</sub>H<sub>28</sub>CIN<sub>3</sub>O (M= 433.98)  
calc.: molar peak (M+H)<sup>+</sup>: 434/436      fnd.: molar peak (M+H)<sup>+</sup>: 434/436  
R<sub>f</sub> value: 0.34 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)
- 25 1.1.k. 7-(4-chloro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3H-quinazolin-4-one  
0.46 g (1.06 mmol) of 4'-chloro-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide and 5 ml of formic acid are stirred for 3h at ambient temperature and 2h at 100°C. The reaction mixture is combined with water, made alkaline with 6N sodium hydroxide solution and the precipitate is

suction filtered. The precipitate is taken up in dichloromethane and dried over magnesium sulphate. The solvent is distilled off using the rotary evaporator and the residue is triturated with diisopropylether.

Yield: 0.3 g (64.6 % of theory)

5 melting point: 178-179°C

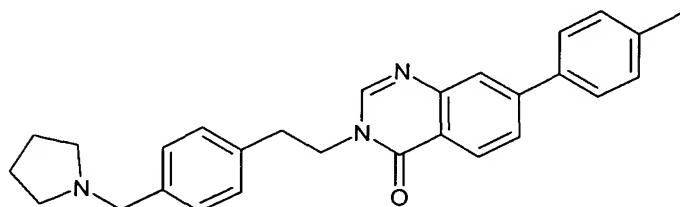
$C_{27}H_{26}ClN_3O$  ( $M= 443.98$ )

calc.: molar peak  $(M+H)^+$ : 444      fnd.: molar peak  $(M+H)^+$ : 444

$R_f$  value: 0.35 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

10

**Example 1.2:** 3-[2-(4-Pyrrolidin-1-ylmethyl-phenyl)-ethyl]-7-p-tolyl-3*H*-quinazolin-4-one



15

1.2.a. 4'-methyl-3-nitro-biphenyl-4-carboxylic acid

Prepared analogously to Example 1.1.b from 4-bromo-2-nitro-benzoic acid and 4-methyl-phenyl-boric acid.

Yield: 1.48 g (70.8 % of theory)

20

$C_{14}H_{11}NO_4$  ( $M= 257.24$ )

calc.: molar peak  $(M-H)^-$ : 256      fnd.: molar peak  $(M-H)^-$ : 256

$R_f$  value: 0.54 (silica gel, dichloromethane/methanol/acetic acid 9:1:0.1)

25

1.2.b. 4'-methyl-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.1.i from 4'-methyl-3-nitro-biphenyl-4-carboxylic acid and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine.

Yield: 0,51 g (78.3 % of theory)

C<sub>27</sub>H<sub>29</sub>N<sub>3</sub>O<sub>3</sub> (M= 443,55)

calc.: molar peak (M+H)<sup>+</sup>: 444      fnd.: molar peak (M+H)<sup>+</sup>: 444

R<sub>f</sub> value: 0.35 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

5

1.2.c. 4'-methyl-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.1.j from 4'-methyl-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide.

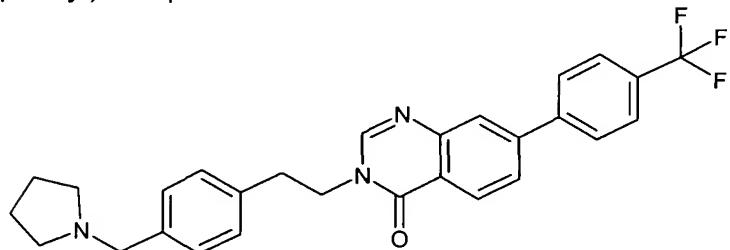
10 Yield: 0.2 g (69.2 % of theory)

C<sub>28</sub>H<sub>31</sub>N<sub>3</sub>O (M= 413.56)

calc.: molar peak (M+H)<sup>+</sup>: 414      fnd.: molar peak (M+H)<sup>+</sup>: 414

R<sub>f</sub> value: 0.36 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

15 **Example 1.3:** 3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-7-(4-trifluormethyl-phenyl)-3*H*-quinazolin-4-one



20 1.3.a. 4'-trifluoromethyl-3-nitro-biphenyl-4-carboxylic acid

Prepared analogously to Example 1.1.b from 4-bromo-2-nitro-benzoic acid and 4-trifluoromethyl-phenyl-boric acid.

Yield: 1.24 g (49 % of theory)

C<sub>14</sub>H<sub>8</sub>F<sub>3</sub>NO<sub>4</sub> (M= 311.21)

25 calc.: molar peak (M-H)<sup>-</sup>: 310      fnd.: molar peak (M-H)<sup>-</sup>: 310

R<sub>f</sub> value: 0.3 (silica gel, dichloromethane/methanol/acetic acid 9:1:0.1)

1.3.b. 4'-trifluoromethyl-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.1.i from 4'-trifluoromethyl-3-nitro-biphenyl-4-carboxylic acid and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine.

Yield: 0.36 g (49.3 % of theory)

C<sub>27</sub>H<sub>26</sub>F<sub>3</sub>N<sub>3</sub>O<sub>3</sub> (M= 497.52)

calc.: molar peak (M+H)<sup>+</sup>: 498      fnd.: molar peak (M+H)<sup>+</sup>: 498

R<sub>f</sub> value: 0.3 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

10

1.3.c. 4'-trifluoromethyl-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

A reaction mixture of 0.1 g (0.2 mmol) of 4'-trifluoromethyl-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide and 0.08 g

15 platinum oxide in 50 ml ethyl acetate is hydrogenated at 20°C for 2.5h. The catalyst is filtered off. The purification is carried out by column chromatography on silica gel (eluant: dichloromethane/ methanol/ammonia= 90:10:1).

Yield: 0.06 g (63.8 % of theory)

C<sub>27</sub>H<sub>28</sub>N<sub>3</sub>N<sub>3</sub>O (M= 467.53)

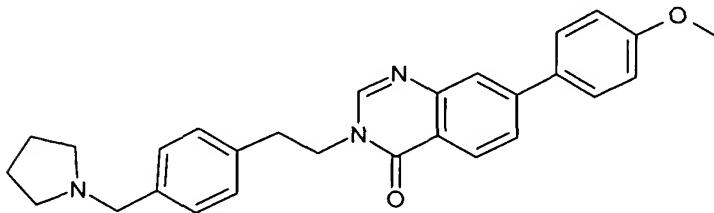
20

calc.: molar peak (M+H)<sup>+</sup>: 468      fnd.: molar peak (M+H)<sup>+</sup>: 468

R<sub>f</sub> value: 0.46 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

**Example 1.4:** 7-(4-Methoxy-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one

25



1.4.a. 4'-methoxy-3-nitro-biphenyl-4-carboxylic acid

Prepared analogously to Example 1.1.b from 4-bromo-2-nitro-benzoic acid and 4-methoxy-phenyl-boric acid.

Yield: 0.38 g (48.9 % of theory)

5 C<sub>14</sub>H<sub>11</sub>NO<sub>5</sub> (M= 273.24)

calc.: molar peak (M-H)<sup>-</sup>: 272 fnd.: molar peak (M-H)<sup>-</sup>: 272

R<sub>f</sub> value: 0.39 (silica gel, dichloromethane/methanol/acetic acid 9:1:0.1)

1.4.b. 4'-methoxy-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

10 Prepared analogously to Example 1.1.j from 4'-methoxy-3-nitro-biphenyl-4-carboxylic acid and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine.

Yield: 0.23 g (57 % of theory)

C<sub>27</sub>H<sub>29</sub>N<sub>3</sub>O<sub>4</sub> (M= 459.55)

15 calc.: molar peak (M+H)<sup>+</sup>: 460 fnd.: molar peak (M+H)<sup>+</sup>: 460

R<sub>f</sub> value: 0.48 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

1.4.c. 4'-methoxy-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

20 Prepared analogously to Example 1.3.c from 4'-methoxy-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide.

Yield: 0.09 g (42 % of theory)

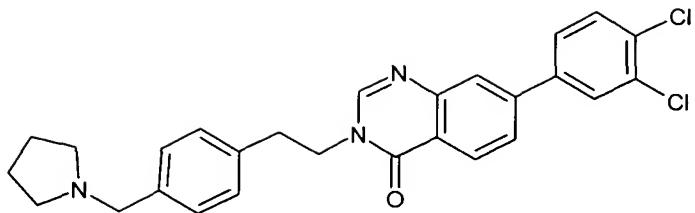
C<sub>27</sub>H<sub>31</sub>N<sub>3</sub>O<sub>2</sub> (M= 429.56)

calc.: molar peak (M+H)<sup>+</sup>: 430 fnd.: molar peak (M+H)<sup>+</sup>: 430

25 R<sub>f</sub> value: 0.44 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

**Example 1.5:**

7-(3,4-dichloro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one



1.5.a. 3',4'-dichloro-3-nitro-biphenyl-4-carboxylic acid

Prepared analogously to Example 1.1.b from 4-bromo-2-nitro-benzoic acid and

5 3,4-dichloro-phenyl-boric acid.

Yield: 0.72 g (28.4 % of theory)

C<sub>13</sub>H<sub>7</sub>Cl<sub>2</sub>NO<sub>4</sub> (M= 312.11)

calc.: molar peak (M-H)<sup>-</sup>: 310/312/314      fnd.: molar peak (M-H)<sup>-</sup>: 310/312/314

R<sub>f</sub> value: 0.39 (silica gel, dichloromethane/methanol/acetic acid 9:1:0.1)

10

1.5.b. 3',4'-dichloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.1.i from 3',4'-dichloro-3-nitro-biphenyl-4-carboxylic acid and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine.

15 Yield: 0.47 g (64.2 % of theory)

C<sub>26</sub>H<sub>25</sub>Cl<sub>2</sub>N<sub>3</sub>O<sub>3</sub> (M= 498.41)

calc.: molar peak (M+H)<sup>+</sup>: 498/500/502      fnd.: molar peak (M+H)<sup>+</sup>: 498/500/502

R<sub>f</sub> value: 0.24 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

20

1.5.c. 3',4'-dichloro-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.3.c from 3',4'-dichloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide.

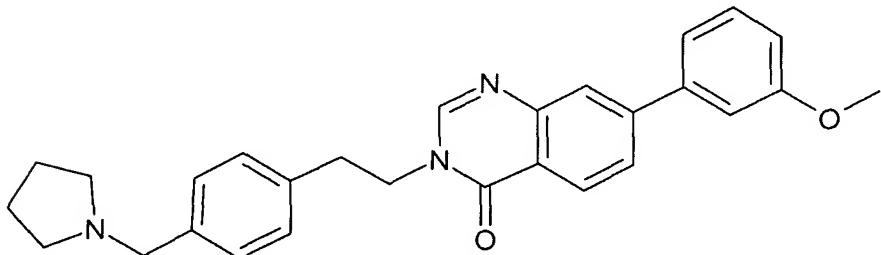
25 Yield: 0.11 g (25 % of theory)

C<sub>26</sub>H<sub>27</sub>Cl<sub>2</sub>N<sub>3</sub>O (M= 468.43)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 468/470/472      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 468/470/472

$R_f$  value: 0.46 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

- 5    **Example 1.6:**  
7-(3-methoxy-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one



- 10    1.6.a. 3'-methoxy-3-nitro-biphenyl-4-carboxylic acid

Prepared analogously to Example 1.1.b from 4-bromo-2-nitro-benzoic acid and 3-methoxy-phenyl-boric acid.

Yield: 0.39 g (73.6 % of theory)

C<sub>14</sub>H<sub>11</sub>NO<sub>5</sub> (M= 273.24)

- 15    calc.: molar peak ( $M+H$ )<sup>+</sup>: 274      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 274

$R_f$  value: 0.35 (silica gel, dichloromethane/methanol/acetic acid 9:1:0.1)

1.6.b. 3'-methoxy-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

- 20    Prepared analogously to Example 1.1.i from 3'-methoxy-3-nitro-biphenyl-4-carboxylic acid and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine.

Yield: 0.39 g (57 % of theory)

C<sub>27</sub>H<sub>29</sub>N<sub>3</sub>O<sub>4</sub> (M= 459.55)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 460      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 460

- 25     $R_f$  value: 0.23 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

1.6.c. 3'-methoxy-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.1.j from 3'-methoxy-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide.

Yield: 0.11 g (30.6 % of theory)

C<sub>27</sub>H<sub>31</sub>N<sub>3</sub>O<sub>2</sub> (M= 429.56)

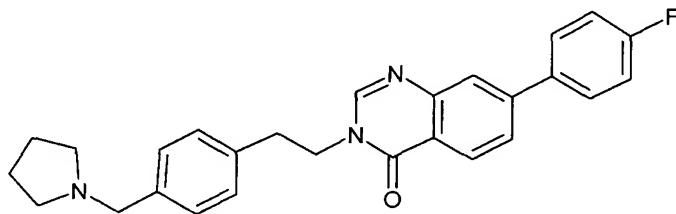
calc.: molar peak (M+H)<sup>+</sup>: 430      fnd.: molar peak (M+H)<sup>+</sup>: 430

R<sub>f</sub> value: 0.36 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

10

**Example 1.7:**

7-(4-fluoro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one



15 1.7.a. 4'-fluoro-3-nitro-biphenyl-4-carboxylic acid

Prepared analogously to Example 1.1.b from 4-bromo-2-nitro-benzoic acid and 4-fluoro-phenyl-boric acid.

Yield: 1.3 g (61.2 % of theory)

C<sub>13</sub>H<sub>8</sub>FNO<sub>4</sub> (M= 261.21)

20 calc.: molar peak (M-H)<sup>-</sup>: 260      fnd.: molar peak (M-H)<sup>-</sup>: 260

R<sub>f</sub> value: 0.34 (silica gel, dichloromethane/methanol/acetic acid 9:1:0.1)

1.7.b. 4'-fluoro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

25 Prepared analogously to Example 1.1.i from 4'-fluoro-3-nitro-biphenyl-4-carboxylic acid and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine.

Yield: 0.38 g (57.8 % of theory)

C<sub>26</sub>H<sub>26</sub>FN<sub>3</sub>O<sub>3</sub> (M= 447.51)

calc.: molar peak (M+H)<sup>+</sup>: 448      fnd.: molar peak (M+H)<sup>+</sup>: 448

R<sub>f</sub> value: 0.24 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

5

1.7.c. 4'-fluoro-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.3.c from 4'-fluoro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide.

10 Yield: 0.06 g (32 % of theory)

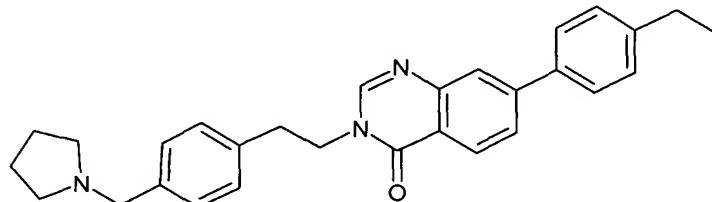
C<sub>26</sub>H<sub>28</sub>FN<sub>3</sub>O (M= 417.53)

calc.: molar peak (M+H)<sup>+</sup>: 418      fnd.: molar peak (M+H)<sup>+</sup>: 418

R<sub>f</sub> value: 0.63 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

15 **Example 1.8:**

7-(4-Ethyl-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one



1.8.a. 4'-Vinyl-3-nitro-biphenyl-4-carboxylic acid

20 Prepared analogously to Example 1.1.b from 4-bromo-2-nitro-benzoic acid and 4-vinyl-phenyl-boric acid.

Yield: 0.58 g (53 % of theory)

C<sub>15</sub>H<sub>11</sub>NO<sub>4</sub> (M= 269.25)

calc.: molar peak (M-H)<sup>-</sup>: 268      fnd.: molar peak (M-H)<sup>-</sup>: 268

25 R<sub>f</sub> value: 0.39 (silica gel, dichloromethane/methanol/acetic acid 9:1:0.1)

1.8.b. 4'-Vinyl-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.1.i from 4'-vinyl-3-nitro-biphenyl-4-carboxylic acid and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine.

5 Yield: 0.38 g (56.8 % of theory)

C<sub>28</sub>H<sub>29</sub>N<sub>3</sub>O<sub>3</sub> (M= 455.56)

calc.: molar peak (M+H)<sup>+</sup>: 456      fnd.: molar peak (M+H)<sup>+</sup>: 456

R<sub>f</sub> value: 0.21 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

10 1.8.c. 4'-ethyl-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.3.c from 4'-vinyl-3-nitro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide.

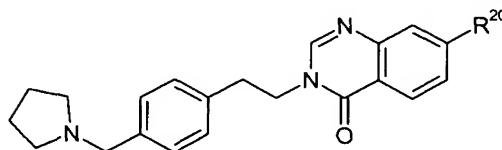
Yield: 0.15 g (63.9 % of theory)

15 C<sub>28</sub>H<sub>33</sub>N<sub>3</sub>O (M= 427.59)

calc.: molar peak (M+H)<sup>+</sup>: 428      fnd.: molar peak (M+H)<sup>+</sup>: 428

R<sub>f</sub> value: 0.47 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

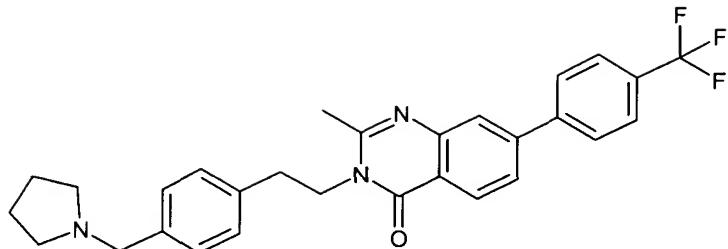
The following compounds were prepared analogously to Example 1.1.k:



| Example | R<sup>20</sup>           | educt | empirical formula  | mass spectrum                | mp [°C] | R <sub>f</sub> value |
|---------|--------------------------|-------|--|------------------------------|---------|----------------------|
| 1.1     | 4-chloro-phenyl          | 1.1.k | C<sub>27</sub>H<sub>26</sub>ClN<sub>3</sub>O             | 444 [M+H] <sup>+</sup>       | 178-179 | 0.35<br>(A)          |
| 1.2     | 4-methyl-phenyl          | 1.2.c | C<sub>28</sub>H<sub>29</sub>N<sub>3</sub>O               | 424 [M+H] <sup>+</sup>       | 157-158 | 0.36<br>(A)          |
| 1.3     | 4-trifluoromethyl-phenyl | 1.3.c | C<sub>28</sub>H<sub>26</sub>F<sub>3</sub>N<sub>3</sub>O  | 478 [M+H] <sup>+</sup>       | 179-181 | 0.4<br>(A)           |
| 1.4     | 4-methoxy-phenyl         | 1.4.c | C<sub>28</sub>H<sub>29</sub>N<sub>3</sub>O<sub>2</sub>   | 440 [M+H] <sup>+</sup>       | 143-144 | 0.37<br>(A)          |
| 1.5     | 3,4-dichloro-phenyl      | 1.5.c | C<sub>27</sub>H<sub>25</sub>Cl<sub>2</sub>N<sub>3</sub>O | 478/80/82 [M+H] <sup>+</sup> | 148-149 | 0.36<br>(A)          |
| 1.6     | 3-methoxy-phenyl         | 1.6.c | C<sub>28</sub>H<sub>29</sub>N<sub>3</sub>O<sub>2</sub>   | 440 [M+H] <sup>+</sup>       | wax     | 0.14<br>(A)          |
| 1.7     | 4-fluoro-phenyl          | 1.7.c | C<sub>27</sub>H<sub>26</sub>FN<sub>3</sub>O              | 428 [M+H] <sup>+</sup>       | 160-161 | 0.45<br>(A)          |
| 1.8     | 4-ethyl-phenyl           | 1.8.c | C<sub>29</sub>H<sub>31</sub>N<sub>3</sub>O               | 438 [M+H] <sup>+</sup>       | 165-166 | 0.37<br>(A)          |

5 R<sub>f</sub> value: A= (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

**Example 1.9**



5    1.9.a 7-(4-trifluoromethyl-phenyl)-2-methyl-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3H-quinazolin-4-one

A solution of 0.07 g (0.15 mmol) of 4'-trifluoromethyl-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide (cf. Example 1.3.c)  
10    in 4 ml acetic acid and 0.028 ml (0.3 mmol) of acetic anhydride is refluxed for 12 hours. The reaction solution is diluted with water, adjusted to pH 8 with dilute sodium hydroxide solution and extracted with dichloromethane. The organic phase is dried over magnesium sulphate. The purification is carried out by column chromatography on silica gel (eluant: dichloromethane/methanol/ammonia  
15    90:10:1)

Yield: 0.008 g (11 % of theory)

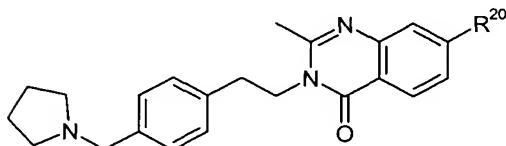
C<sub>29</sub>H<sub>28</sub>F<sub>3</sub>N<sub>3</sub>O (M= 491.56)

calc.: molar peak (M+H)<sup>+</sup>: 492        fnd.: molar peak (M+H)<sup>+</sup>: 492

R<sub>f</sub> value: 0.36 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

20

The following compounds were prepared analogously to Example 1.9.a:



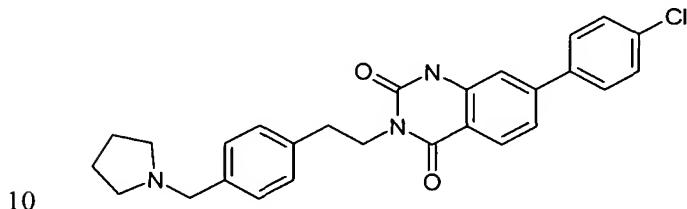
| Example | R <sup>20</sup>          | educt | empirical formula   | mass spectrum             | mp [°C] | R <sub>f</sub> value |
|---------|--------------------------|-------|---|---------------------------|---------|----------------------|
| 1.9     | 4-trifluoromethyl-phenyl | 1.3.c | C <sub>29</sub> H <sub>28</sub> F <sub>3</sub> N <sub>3</sub> O | 492 [M+H] <sup>+</sup>    | wax     | 0.36 (A)             |
| 1.10    | 4-methyl-phenyl          | 1.2.c | C <sub>29</sub> H <sub>31</sub> N <sub>3</sub> O                | 437 [M+H] <sup>+</sup>    | wax     | 0.66 (A)             |
| 1.11    | 4-chloro-phenyl          | 1.1.j | C <sub>28</sub> H <sub>28</sub> ClN <sub>3</sub> O              | 458/60 [M+H] <sup>+</sup> | 160-163 | 0.40 (A)             |

R<sub>f</sub> value: A= (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

Example 1.10: 2-methyl-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-7-p-tolyl-3H-5 quinazolin-4-one

Example 1.11: 7-(4-chloro-phenyl)-2-methyl-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3H-quinazolin-4-one

### Example 1.12



1.12.a 7-(4-chloro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-1H-quinazolin-2,4-dione

A reaction mixture of 0.3 g (0.69 mmol) of 4'-chloro-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide (cf. Example 1.1.j) and 0.1 g (0.65 mmol) of CDI in 50 ml of tetrahydrofuran is refluxed for 24 hours. Then a further 0.1 g CDI are added and the reaction mixture is refluxed for a further 24 hours. The reaction mixture is evaporated down in the rotary evaporator. The purification is carried out by column chromatography on silica gel (eluant: dichloromethane/methanol/ammonia 60:1:0.1)

Yield: 0.2 g (62.9 % of theory)

melting point: 274-276°C

C<sub>27</sub>H<sub>26</sub>ClN<sub>3</sub>O<sub>2</sub> (M= 459.98)

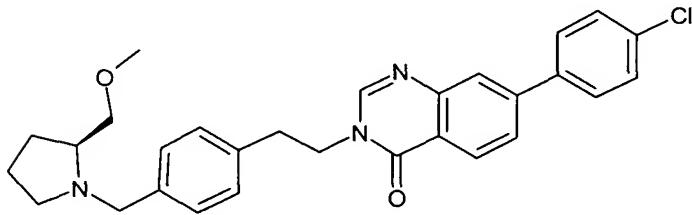
calc.: molar peak (M+H)<sup>+</sup>: 460/462      fnd.: molar peak (M+H)<sup>+</sup>: 460/462

5 R<sub>f</sub> value: 0.1 (silica gel, dichloromethane/methanol/ammonia 50:1:0.1)

**Example 1.13:**

7-(4-chloro-phenyl)-3-{2-[4-((S)-2-methoxymethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-quinazolin-4-one

10



1.13.a [4-(2-(S)-methoxymethyl-pyrrolidin-1-ylmethyl)-phenyl]-acetonitrile

Prepared analogously to Example 1.1.g from 2-(S)-methoxymethyl-pyrrolidine and (4-bromomethyl-phenyl)-acetonitrile.

15 Yield: 0.9 g (51.6 % of theory)

C<sub>15</sub>H<sub>20</sub>N<sub>2</sub>O (M= 244.33)

calc.: molar peak (M+H)<sup>+</sup>: 245      fnd.: molar peak (M+H)<sup>+</sup>: 245

R<sub>f</sub> value: 0.3 (silica gel, cyclohexane/ethyl acetate 1:1)

20 1.13.b 2-[4-(2-(S)-methoxymethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethylamine

Prepared analogously to Example 1.1.h from [4-(2-(S)-methoxymethyl-pyrrolidin-1-ylmethyl)-phenyl]-acetonitrile

Yield: 0.5 g (54.7 % of theory)

C<sub>15</sub>H<sub>24</sub>N<sub>2</sub>O (M= 248.37)

25 calc.: molar peak (M+H)<sup>+</sup>: 249      fnd.: molar peak (M+H)<sup>+</sup>: 249

R<sub>f</sub> value: 0.3 (silica gel, dichloromethane/ethanol/ammonia 20:1:0.1)

1.13.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[4-(2-(S)-methoxymethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide

Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-[4-(2-(S)-methoxymethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethylamine.

5 Yield: 0.5 g (54.7 % of theory)

C<sub>28</sub>H<sub>30</sub>ClN<sub>3</sub>O<sub>4</sub> (M= 508.02)

calc.: molar peak (M+H)<sup>+</sup>: 508/510      fnd.: molar peak (M+H)<sup>+</sup>: 508/510

R<sub>f</sub> value: 0.6 (silica gel, dichloromethane/ethanol/ammonia 20:1:0.1)

10 1.13.d 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[4-(2-(S)-methoxymethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide

Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[4-(2-(S)-methoxymethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide.

15 Yield: 0.24 g (51 % of theory)

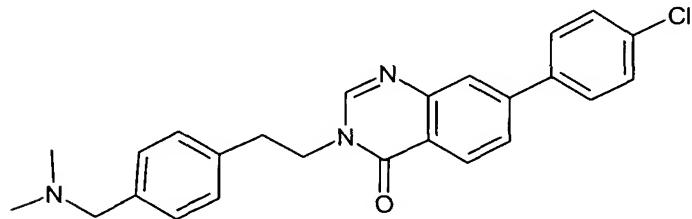
C<sub>28</sub>H<sub>32</sub>ClN<sub>3</sub>O<sub>2</sub> (M= 478.03)

calc.: molar peak (M+H)<sup>+</sup>: 478/480      fnd.: molar peak (M+H)<sup>+</sup>: 478/480

R<sub>f</sub> value: 0.2 (silica gel, dichloromethane/methanol/ammonia 10:1:0.1)

20 **Example 1.14:**

7-(4-chloro-phenyl)-3-[2-(4-dimethylaminomethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one



25 1.14.a (4-dimethylaminomethyl-phenyl)-acetonitrile

Prepared analogously to Example 1.1.g from dimethylamine and (4-bromomethyl-phenyl)-acetonitrile.

Yield: 1.0 g (30 % of theory)

C<sub>11</sub>H<sub>14</sub>N<sub>2</sub> (M= 174.24)

calc.: molar peak (M+H)<sup>+</sup>: 175      fnd.: molar peak (M+H)<sup>+</sup>: 175

R<sub>f</sub> value: 0.2 (silica gel, cyclohexane/ethyl acetate 1:1)

5

1.14.b 2-(4-dimethylaminomethyl-phenyl)-ethylamine

Prepared analogously to Example 1.1.h from (4-dimethylaminomethyl-phenyl)-acetonitrile

Yield: 1.0 g crude

10 C<sub>11</sub>H<sub>18</sub>N<sub>2</sub> (M= 178.28)

calc.: molar peak (M+H)<sup>+</sup>: 179      fnd.: molar peak (M+H)<sup>+</sup>: 179

R<sub>f</sub> value: 0.2 (silica gel, dichloromethane/ethanol/ammonia 20:1:0.1)

15 1.14.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-dimethylaminomethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-(4-dimethylaminomethyl-phenyl)-ethylamine

Yield: 0.5 g (63.4 % of theory)

C<sub>24</sub>H<sub>24</sub>ClN<sub>3</sub>O<sub>3</sub> (M= 437.93)

20 calc.: molar peak (M+H)<sup>+</sup>: 438/440      fnd.: molar peak (M+H)<sup>+</sup>: 438/440

R<sub>f</sub> value: 0.35 (silica gel, dichloromethane/ethanol/ammonia 20:1:0.1)

1.14.d 4'-chloro-3-amino-biphenyl-4-carboxylic acid-[2-(4-dimethylaminomethyl-phenyl)-ethyl]-amide

25 Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-dimethylaminomethyl-phenyl)-ethyl]-amide

Yield: 0.2 g (43 % of theory)

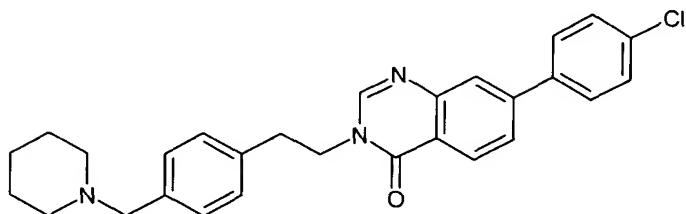
C<sub>24</sub>H<sub>26</sub>ClN<sub>3</sub>O (M= 407.94)

calc.: molar peak (M+H)<sup>+</sup>: 408/410      fnd.: molar peak (M+H)<sup>+</sup>: 408/410

30 R<sub>f</sub> value: 0.2 (silica gel, dichloromethane/methanol/ammonia 20:1:0.1)

**Example 1.15:**

7-(4-chloro-phenyl)-3-[2-(4-piperidin-1-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one



5    1.15.a (4-piperidin-1-ylmethyl-phenyl)-acetonitrile

Prepared analogously to Example 1.1.g from piperidine and (4-bromomethyl-phenyl)-acetonitrile.

Yield: 1.6 g (39 % of theory)

C<sub>14</sub>H<sub>18</sub>N<sub>2</sub> (M= 214.31)

10    calc.: molar peak (M+H)<sup>+</sup>: 215                  fnd.: molar peak (M+H)<sup>+</sup>: 215

R<sub>f</sub> value: 0.4 (silica gel, cyclohexane/ethyl acetate 1:1)

1.15.b 2-(4-piperidin-1-ylmethyl-phenyl)-ethylamine

Prepared analogously to Example 1.1.h from (4-piperidin-1-ylmethyl-phenyl)-

15    acetonitrile

Yield: 1.4 g (85.9 % of theory)

C<sub>14</sub>H<sub>22</sub>N<sub>2</sub> (M= 218.34)

calc.: molar peak (M+H)<sup>+</sup>: 219                  fnd.: molar peak (M+H)<sup>+</sup>: 219

R<sub>f</sub> value: 0.2 (silica gel, dichloromethane/ethanol/ammonia 20:1:0.1)

20

1.15.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-piperidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-(4-piperidin-1-ylmethyl-phenyl)-ethylamine.

25    Yield: 0.07 g (40.7 % of theory)

C<sub>27</sub>H<sub>28</sub>ClN<sub>3</sub>O<sub>3</sub> (M= 477.99)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 478/480      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 478/480

$R_f$  value: 0.5 (silica gel, dichloromethane/ethanol/ammonia 20:1:0.1)

- 1.15.d 4'-chloro-3-amino-biphenyl-4-carboxylic acid-[2-(4-piperidin-1-ylmethyl-phenyl)-ethyl]-amide  
5

Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-piperidin-1-ylmethyl-phenyl)-ethyl]-amide

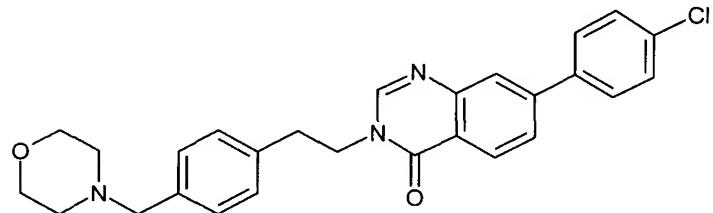
Yield: 0.05 g (76.4 % of theory)

$C_{27}H_{30}ClN_3O$  ( $M= 448.01$ )

10

**Example 1.16:**

7-(4-chloro-phenyl)-3-[2-(4-morpholin-4-ylmethyl-phenyl)-ethyl]-3*H*-quinazolin-4-one



15

- 1.16.a (4-morpholin-4-ylmethyl-phenyl)-acetonitrile

Prepared analogously to Example 1.1.g from morpholine and (4-bromomethyl-phenyl)-acetonitrile.

Yield: 1.63 g (98.9 % of theory)

20

$C_{13}H_{16}N_2O$  ( $M= 216.28$ )

calc.: molar peak ( $M+H$ )<sup>+</sup>: 217      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 217

$R_f$  value: 0.33 (silica gel, cyclohexane/ethyl acetate 1:1)

- 1.16.b 2-(4-morpholin-1-ylmethyl-phenyl)-ethylamine

25

Prepared analogously to Example 1.1.h from (4-morpholin-1-ylmethyl-phenyl)-acetonitrile

Yield: 1.65 g (99.4 % of theory)

C<sub>13</sub>H<sub>20</sub>N<sub>2</sub>O (M= 220.31)

calc.: molar peak (M+H)<sup>+</sup>: 221      fnd.: molar peak (M+H)<sup>+</sup>: 221

R<sub>f</sub> value: 0.54 (silica gel, dichloromethane/ethanol/ammonia 9:1:0.1)

- 5    1.16.c    4'-chloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-morpholin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-(4-morpholin-1-ylmethyl-phenyl)-ethylamine.

Yield: 0.53 g (76.6 % of theory)

- 10    C<sub>26</sub>H<sub>26</sub>CIN<sub>3</sub>O<sub>4</sub> (M= 479.97)

calc.: molar peak (M+H)<sup>+</sup>: 480/482      fnd.: molar peak (M+H)<sup>+</sup>: 480/482

R<sub>f</sub> value: 0.5 (silica gel, dichloromethane/ethanol/ammonia 90:1:0.1)

- 15    1.16.d    4'-chloro-3-amino-biphenyl-4-carboxylic acid-[2-(4-morpholin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-[2-(4-morpholin-1-ylmethyl-phenyl)-ethyl]-amide

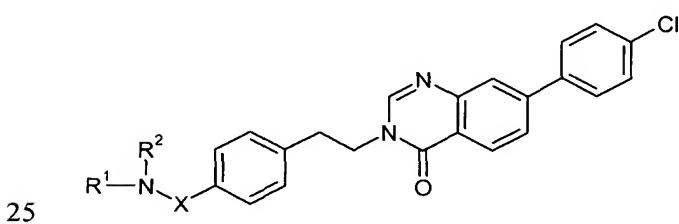
Yield: 0.45 g (90.6 % of theory)

C<sub>26</sub>H<sub>28</sub>CIN<sub>3</sub>O<sub>2</sub> (M= 449.98)

- 20    calc.: molar peak (M+H)<sup>+</sup>: 450/452      fnd.: molar peak (M+H)<sup>+</sup>: 450/452

R<sub>f</sub> value: 0.67 (silica gel, dichloromethane/ethanol/ammonia 90:1:0.1)

The following compounds were prepared analogously to Example 1.1.k:



| Example | R <sup>1</sup> R <sup>2</sup> N-X- | educt  | empirical formula   | mass spectrum              | mp [°C] | R <sub>f</sub> value |
|---------|------------------------------------|--------|---|----------------------------|---------|----------------------|
| 1.13    |                                    | 1.13.d | C <sub>29</sub> H <sub>30</sub> CIN <sub>3</sub> O <sub>2</sub> | 488/490 [M+H] <sup>+</sup> | 133-135 | 0.3 (C)              |
| 1.14    |                                    | 1.14.d | C <sub>25</sub> H <sub>24</sub> CIN <sub>3</sub> O              | 418/420 [M+H] <sup>+</sup> | 183     | 0.66 (C)             |
| 1.15    |                                    | 1.15.d | C <sub>28</sub> H <sub>28</sub> CIN <sub>3</sub> O              | 458 [M+H] <sup>+</sup>     | 169-170 | 0.4 (D)              |
| 1.16    |                                    | 1.16.d | C <sub>27</sub> H <sub>26</sub> CIN <sub>3</sub> O <sub>2</sub> | 460/462 [M+H] <sup>+</sup> | 169-170 | 0.77 (A)             |

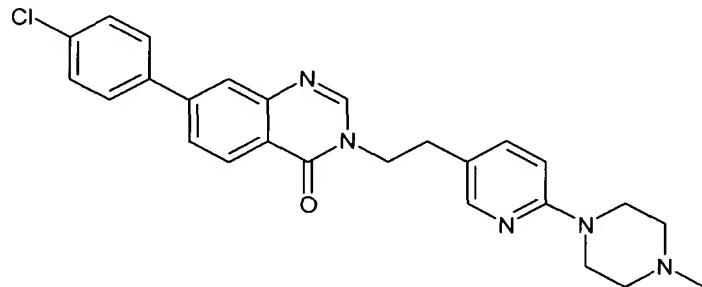
R<sub>f</sub> value: A= (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

C= (silica gel, dichloromethane/methanol/ammonia 10:1:0.1)

D= (silica gel, dichloromethane/ethanol/ammonia 20:1:0.1)

5

**Example 1.17** 7-(4-chloro-phenyl)-3-{2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethyl}-3H-quinazolin-4-one



10 1.17.a (6-chloro-pyridin-3-yl)-acetonitrile

A solution of 7.5 g (41.66 mmol) of 2-chloro-5-chloromethyl-pyridine, dissolved in 100 ml of ethanol, is added dropwise to a solution of 6.91 g (41.66 mmol) of potassium iodide and 2.24 g (49.01 mmol) of sodium cyanide in 400 ml of an ethanol/water mixture (9:1). Then the reaction mixture is heated to 85°C for five hours. The solvent is substantially distilled off in vacuo and the residue is extracted

with water and ethyl acetate. The organic phase is washed with water three times and dried over sodium sulphate. The purification is carried out by column chromatography on silica gel (eluant: dichloromethane/ethanol).

Yield: 2.9 g (45.6 % of theory)

5 C<sub>7</sub>H<sub>5</sub>CIN<sub>2</sub> (M= 152.58)

calc.: molar peak (M+H)<sup>+</sup>: 151/153      fnd.: molar peak (M+H)<sup>+</sup>: 151/153.

1.17.b [6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-acetonitrile

A solution of 2.9 g (19 mmol) of (6-chloro-pyridin-3-yl)-acetonitrile, 5.27 ml (38 mmol) of triethylamine and 2.1 ml (19 mmol) of N-methylpiperazine in 50 ml of n-butanol is heated to 180°C for two hours in the microwave. The solvent is distilled off in vacuo, the residue suspended in water and then extracted with ethyl acetate. The combined organic phases are extracted three times with water and dried over sodium sulphate. The purification is carried out by column chromatography on 15 Alox (eluant: petroleum ether/ ethyl acetate 1:1).

Yield: 1 g (24.6 % of theory)

melting point: 58-59°C

C<sub>12</sub>H<sub>16</sub>N<sub>4</sub> (M= 216.28)

calc.: molar peak (M+H)<sup>+</sup>: 217      fnd.: molar peak (M+H)<sup>+</sup>: 217

20 R<sub>f</sub> value: 0.35 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1).

1.17.c 2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethylamine

Prepared analogously to Example 1.1.i from [6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-acetonitrile.

25 Yield: 0.94 g (96 % of theory)

C<sub>12</sub>H<sub>20</sub>N<sub>4</sub> (M= 220.32)

calc.: molar peak (M+H)<sup>+</sup>: 221      fnd.: molar peak (M+H)<sup>+</sup>: 221.

1.17.d 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[6-(4-methyl-piperazin-1-yl)-

30 pyridin-3-yl]-ethyl}-amide

Prepared analogously to Example 1.1.j from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethylamine.

Yield: 0.48 g (36.7 % of theory)

melting point: 158-159°C

5  $C_{25}H_{26}ClN_5O_3$  ( $M= 479.97$ )

calc.: molar peak ( $M+H$ )<sup>+</sup>: 480/482      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 480/482.

1.17.e 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethyl}-amide

10 Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethyl}-amide.

Yield: 0.12 g (64 % of theory)

melting point: 198-199°C

$C_{25}H_{28}ClN_5O$  ( $M= 449.98$ )

15 calc.: molar peak ( $M+H$ )<sup>+</sup>: 450/452      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 450/452.

1.17.f 7-(4-chloro-phenyl)-3-{2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethyl}-3H-quinazolin-4-one

Prepared analogously to Example 1.1.l from 4'-chloro-3-amino-biphenyl-4-

20 carboxylic acid-{2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethyl}-amide and formic acid.

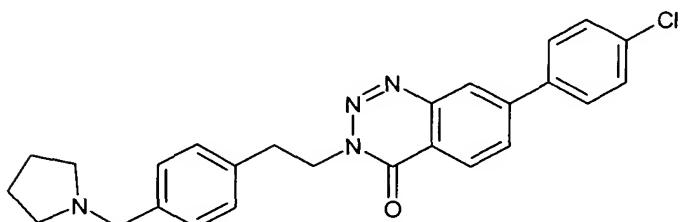
Yield: 0.06 g (53.5 % of theory)

melting point: 263-264°C

$C_{26}H_{26}ClN_5O$  ( $M= 459.98$ )

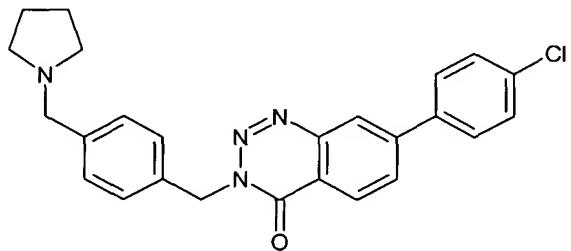
25 calc.: molar peak ( $M+H$ )<sup>+</sup>: 460/462      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 4460/462.

**Example 1.18** 7-(4-chloro-phenyl)-3-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-3*H*-benzo[*d*][1,2,3]triazin-4-one



- 5    1.18.a 7-(4-chloro-phenyl)-3-{2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethyl}-3*H*-benzo[*d*][1,2,3]triazin-4-one  
A solution of 0.09 g (0.93 mmol) of sodium nitrite in 2 ml of water is slowly added dropwise to a solution of 0.27 g (0.62 mmol) of 4'-chloro-3-amino-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide (cf. Example 1.1.j)  
10    in 10 ml of methanol and 1N hydrochloric acid at a temperature between 0°C and 5°C. Then the reaction mixture is stirred for three hours at ambient temperature, then diluted with 30 ml of water and made alkaline with ammonia solution. The aqueous solution is extracted with ethyl acetate. The combined organic phases are washed with water three times, dried over sodium sulphate and filtered  
15    through activated charcoal. The solvent is removed and the residue washed with diisopropylether.  
Yield: 0.09 g (32.5 % of theory)  
melting point: 151-152°C  
 $C_{26}H_{25}ClN_4O$  ( $M= 444.96$ )  
20    calc.: molar peak  $(M+H)^+$ : 445/447        fnd.: molar peak  $(M+H)^+$ : 445/447  
 $R_f$  value: 0.35 (silica gel, dichloromethane/ethanol=10:1).

**Example 1.19 7-(4-chloro-phenyl)-3-(4-pyrrolidin-1-ylmethyl-benzyl)-3H-benzo[d][1,2,3]triazin-4-one**



5

**1.19.a 4-(1-pyrrolidin-1-yl-ethyl)-benzonitrile**

Prepared analogously to Example 1.1.g from piperidine and 4-bromomethylbenzonitrile

Yield: 2.4 g (85.9 % of theory)

10  $C_{12}H_{14}N_2$  ( $M = 186.25$ )

calc.: molar peak  $(M+H)^+$ : 187      fnd.: molar peak  $(M+H)^+$ : 187

$R_f$  value: 0.63 (silica gel, dichloromethane/ methanol/ammonia=8:2:1).

**1.19.b 4-(1-pyrrolidin-1-yl-ethyl)-benzylamine**

15 Prepared analogously to Example 1.1.h from 4-(1-pyrrolidin-1-yl-ethyl)-benzonitrile

Yield: 2.42 g (98.7 % of theory)

$C_{12}H_{18}N_2$  ( $M = 190.29$ )

calc.: molar peak  $(M+H)^+$ : 191      fnd.: molar peak  $(M+H)^+$ : 191

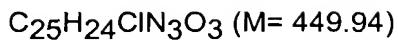
$R_f$  value: 0.26 (silica gel, dichloromethane/ methanol/ammonia=90:10:1).

20

**1.19.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-4-(1-pyrrolidin-1-yl-ethyl)-benzylamide**

Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-(4-(1-pyrrolidin-1-yl-ethyl)-benzylamine.

25 Yield: 0.28 g (28.8 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 450/452      fnd.: molar peak (M+H)<sup>+</sup>: 450/452.

1.19.d. 3-amino-4'-chloro-biphenyl-4-carboxylic acid-4-(1-pyrrolidin-1-yl-ethyl)-  
5 benzylamide

Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-4-(1-pyrrolidin-1-yl-ethyl)-benzylamide.

Yield: 0.19 g (72.7 % of theory)



10 calc.: molar peak (M+H)<sup>+</sup>: 420/422      fnd.: molar peak (M+H)<sup>+</sup>: 420/422.

1.19.e 7-(4-chloro-phenyl)-3-[4-(1-pyrrolidin-1-yl-ethyl)-benzyl]-3H-benzo[d][1,2,3]triazin-4-one

Prepared analogously to Example 1.18.a from 3-amino-4'-chloro-biphenyl-4-carboxylic acid-4-(1-pyrrolidin-1-yl-ethyl)-benzylamide.

Yield: 0.045 g (31.4 % of theory)

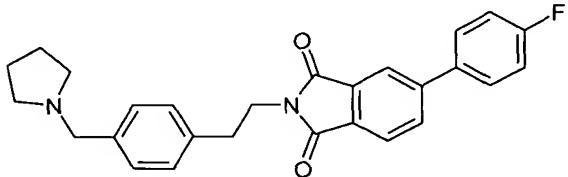
melting point: 147-148°C



calc.: molar peak (M+H)<sup>+</sup>: 431/433      fnd.: molar peak (M+H)<sup>+</sup>: 431/433

20 R<sub>f</sub> value: 0.3 (silica gel, dichloromethane/ethanol=10:1).

**Example 1.20** 5-(4-fluoro-phenyl)-2-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-isoindol-1,3-dione

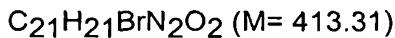


25

1.20.a 5-bromo-2-{2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethyl}-isoindol-1,3-dione

A solution of 0.8 g (3.52 mmol) of 5-bromo-isobenzofuran-1,3-dione and 0.72 g (3.52 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (cf. Example 1.1.h) in 10 ml acetic acid is heated to 110°C for four hours. Then the reaction mixture is poured into water, made alkaline with 2N sodium hydroxide solution and the precipitate is filtered off. The precipitate is washed several times with water and dried.

5 Yield: 0.5 g (34.3 % of theory)



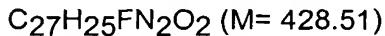
calc.: molar peak  $(\text{M}+\text{H})^+$ : 413/415      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 413/415.

10

1.20.b. 5-(4-fluoro-phenyl)-2-{2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethyl}-isoindol-1,3-dione

Prepared analogously to Example 1.1.b from 5-bromo-2-{2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethyl}-isoindol-1,3-dione and 4-fluoro-phenylboric acid.

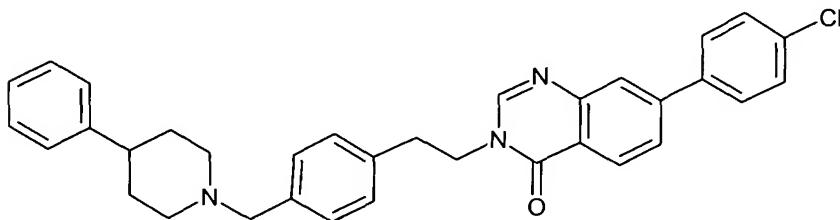
15 Yield: 0.01 g (4.8 % of theory)



calc.: molar peak  $(\text{M}+\text{H})^+$ : 429      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 429.

### **Example 1.21:**

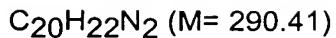
20 7-(4-chloro-phenyl)-3-{2-[4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-quinazolin-4-one



1.21.a [4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-acetonitrile

25 Prepared analogously to Example 1.1.g from 4-phenylpiperidine and (4-bromomethyl-phenyl)-acetonitrile.

Yield: 3.8 g (98 % of theory)



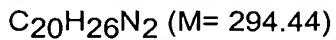
calc.: molar peak (M+H)<sup>+</sup>: 291      fnd.: molar peak (M+H)<sup>+</sup>: 291

R<sub>f</sub> value: 0.5 (silica gel, cyclohexane/ethyl acetate 1:1)

5    1.21.b 2-[4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethylamine

Prepared analogously to Example 1.1.h from [4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-acetonitrile.

Yield: 3.6 g crude



10    calc.: molar peak (M+H)<sup>+</sup>: 295      fnd.: molar peak (M+H)<sup>+</sup>: 295

R<sub>f</sub> value: 0.49 (silica gel, dichloromethane/ethanol 20:1)

1.21.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide

15    Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-[4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethylamine

Yield: 1.33 g (70.7 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 554/556      fnd.: molar peak (M+H)<sup>+</sup>: 554/556

20    R<sub>f</sub> value: 0.58 (silica gel, dichloromethane/ethanol/ammonia 10:1:0.1)

1.21.d 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide

Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-

25    carboxylic acid-{2-[4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide

Yield: 0.82 g (65.2 % of theory)



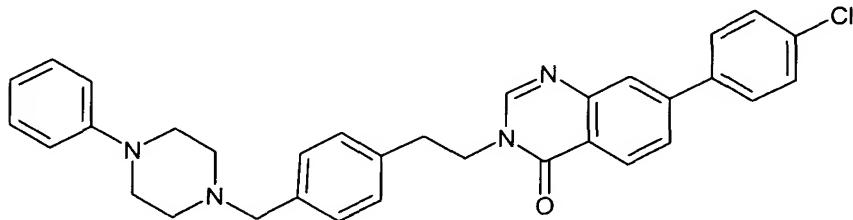
calc.: molar peak (M+H)<sup>+</sup>: 524/526/528      fnd.: molar peak (M+H)<sup>+</sup>: 524/526/528

30    R<sub>f</sub> value: 0.65 (silica gel, dichloromethane/methanol 10:1)

**Example 1.22:**

7-(4-chloro-phenyl)-3-{2-[4-(4-phenyl-piperazin-1-ylmethyl)-phenyl]-ethyl}-3*H*-quinazolin-4-one

5



10 Yield: 3.7 g (97 % of theory)

C<sub>19</sub>H<sub>21</sub>N<sub>3</sub> (M= 291.39)

calc.: molar peak (M+H)<sup>+</sup>: 292      fnd.: molar peak (M+H)<sup>+</sup>: 292

R<sub>f</sub> value: 0.6 (silica gel, cyclohexane/ethyl acetate 1:1)

15 1.22.b 2-[4-(4-phenyl-piperazin-1-ylmethyl)-phenyl]-ethylamine

Prepared analogously to Example 1.1.h from [4-(4-phenyl-piperazin-1-ylmethyl)-phenyl]-acetonitrile

Yield: 1.1 g (28.6 % of theory)

C<sub>19</sub>H<sub>25</sub>N<sub>3</sub> (M= 295.43)

20 calc.: molar peak (M+H)<sup>+</sup>: 296      fnd.: molar peak (M+H)<sup>+</sup>: 296

1.22.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[4-(4-phenyl-piperazin-1-ylmethyl)-phenyl]-ethyl}-amide

Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic

25 acid and 2-[4-(4-phenyl-piperazin-1-ylmethyl)-phenyl]-ethylamine

Yield: 0.32 g (18.2 % of theory)

C<sub>32</sub>H<sub>31</sub>ClN<sub>4</sub>O<sub>3</sub> (M= 555.08)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 555/557      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 555/557

1.22.d 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[4-(4-phenyl-piperazin-1-ylmethyl)-phenyl]-ethyl}-amide

- 5 Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[4-(4-phenyl-piperazin-1-ylmethyl)-phenyl]-ethyl}-amide  
Yield: 0.11 g (38.8 % of theory)

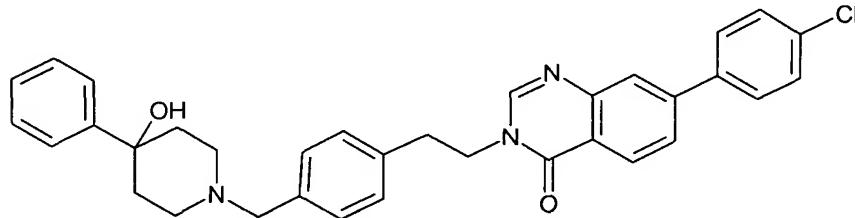


calc.: molar peak ( $M+H$ )<sup>+</sup>: 525/527      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 525/527

10

**Example 1.23:**

7-(4-chloro-phenyl)-3-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-quinazolin-4-one



15

1.23.a [4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-acetonitrile

Prepared analogously to Example 1.1.g from 4-hydroxy-4-phenylpiperidine and (4-bromomethyl-phenyl)-acetonitrile.

Yield: 3.8 g (98 % of theory)

20



calc.: molar peak ( $M+H$ )<sup>+</sup>: 307      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 307

$R_f$  value: 0.1 (silica gel, cyclohexane/ethyl acetate 1:1)

1.23.b 2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethylamine

25 Prepared analogously to Example 1.1.h from [4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-acetonitrile

Yield: 3.36 g (92.1 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 311      fnd.: molar peak (M+H)<sup>+</sup>: 311

R<sub>f</sub> value: 0.1 (silica gel, dichloromethane/methanol/acetic acid 9:1:0.1)

- 5    1.23.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide  
Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethylamine  
Yield: 1.2 g (65.3 % of theory)
- 10   C<sub>33</sub>H<sub>32</sub>CIN<sub>3</sub>O<sub>4</sub> (M= 570.09)  
calc.: molar peak (M+H)<sup>+</sup>: 570/572      fnd.: molar peak (M+H)<sup>+</sup>: 570/572  
R<sub>f</sub> value: 0.35 (silica gel, dichloromethane/methanol/ammonia 10:1:0.1)
- 15   1.23.d 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide  
Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide  
Yield: 1.04 g (91.5 % of theory)
- 20   C<sub>33</sub>H<sub>34</sub>CIN<sub>3</sub>O<sub>2</sub> (M= 540.11)  
melting point: 175-180°C  
calc.: molar peak (M+H)<sup>+</sup>: 540/542/544      fnd.: molar peak (M+H)<sup>+</sup>: 540/542/544  
R<sub>f</sub> value: 0.34 (silica gel, dichloromethane/methanol/ammonia 10:1:0.1)
- 25   1.23.e. 7-(4-chloro-phenyl)-3-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-3H-quinazolin-4-one  
Prepared analogously to Example 1.1.k. from 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide.

Yield: 0.025 g (8.2 % of theory)

melting point: 204-205°C

C<sub>34</sub>H<sub>32</sub>ClN<sub>3</sub>O<sub>2</sub> (M= 550.10)

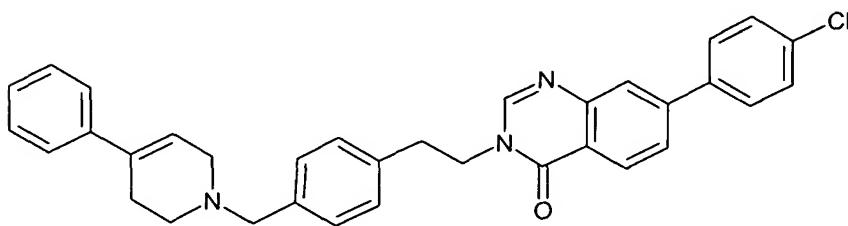
calc.: molar peak (M+H)<sup>+</sup>: 550/552      fnd.: molar peak (M+H)<sup>+</sup>: 550/552

5 R<sub>f</sub> value: 0.46 (silica gel, dichloromethane/ethanol/ammonia 10:1:0.1)

**Example 1.24:**

7-(4-chloro-phenyl)-3-{2-[4-(4-phenyl-3,6-dihydro-2H-piperidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-quinazolin-4-one

10



1.24.a. 7-(4-chloro-phenyl)-3-{2-[4-(4-phenyl-3,6-dihydro-2*H*-piperidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-quinazolin-4-one

Prepared analogously to Example 1.1.k. from 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide as by-product in Example 123.e.

Yield: 0.08 g (27.1 % of theory)

melting point: 166-167°C

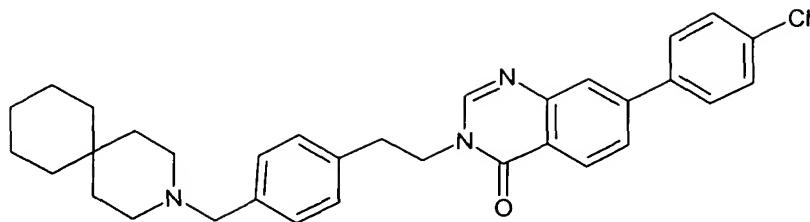
C<sub>34</sub>H<sub>30</sub>ClN<sub>3</sub>O (M= 532.09)

20 calc.: molar peak (M+H)<sup>+</sup>: 532/534      fnd.: molar peak (M+H)<sup>+</sup>: 532/534

R<sub>f</sub> value: 0.57 (silica gel, dichloromethane/ethanol/ammonia 10:1)

**Example 1.25:**

7-(4-chloro-phenyl)-3-{2-[4-(3-Aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethyl}-3*H*-quinazolin-4-one



1.25.a [4-(3-Aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-acetonitrile

Prepared analogously to Example 1.1.g from 3-aza-spiro[5.5]undecane and (4-bromomethyl-phenyl)-acetonitrile.

Yield: 3.38 g (98 % of theory)

C<sub>19</sub>H<sub>26</sub>N<sub>2</sub> (M= 282.43)

calc.: molar peak (M+H)<sup>+</sup>: 283      fnd.: molar peak (M+H)<sup>+</sup>: 283

R<sub>f</sub> value: 0.56 (silica gel, cyclohexane/ethyl acetate 1:1)

10

1.25.b 2-[4-(3-Aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethylamine

Prepared analogously to Example 1.1.h from [4-(3-aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-acetonitrile

Yield: 3.33 g (96.6 % of theory)

15 C<sub>19</sub>H<sub>30</sub>N<sub>2</sub> (M= 286.46)

calc.: molar peak (M+H)<sup>+</sup>: 287      fnd.: molar peak (M+H)<sup>+</sup>: 287

R<sub>f</sub> value: 0.18 (silica gel, dichloromethane/ethanol 20:1)

20 1.25.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[4-(3-aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethyl}-amide

Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-[4-(3-aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethylamine

Yield: 1 g (52.5 % of theory)

C<sub>32</sub>H<sub>36</sub>ClN<sub>3</sub>O<sub>3</sub> (M= 546.11)

25 calc.: molar peak (M+H)<sup>+</sup>: 546/548      fnd.: molar peak (M+H)<sup>+</sup>: 546/548

R<sub>f</sub> value: 0.3 (silica gel, dichloromethane/ethanol 20:1)

1.25.d 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[4-(3-aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethyl}-amide

Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-{2-[4-(3-aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethyl}-amide

5 Yield: 0.8 g (84.7 % of theory)

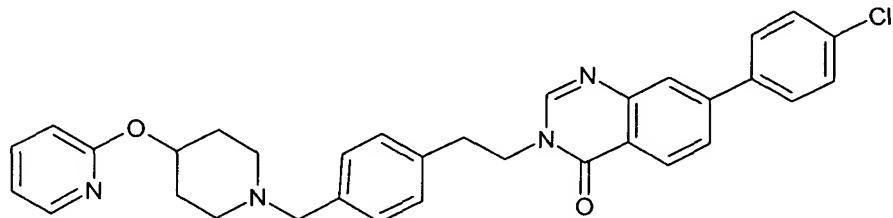
C<sub>32</sub>H<sub>38</sub>ClN<sub>3</sub>O (M= 516.13)

calc.: molar peak (M+H)<sup>+</sup>: 516/518 fnd.: molar peak (M+H)<sup>+</sup>: 516/518

R<sub>f</sub> value: 0.38 (silica gel, dichloromethane/methanol 10:1)

10 **Example 1.26:**

7-(4-chloro-phenyl)-3-(2-{4-[4-(pyridin-2-yloxy)-piperidin-1-ylmethyl]-phenyl}-ethyl)-3*H*-quinazolin-4-one



15 1.26.a {4-[4-(pyridin-2-yloxy)-piperidin-1-ylmethyl]-phenyl}-acetonitrile

Prepared analogously to Example 1.1.g from 2-(piperidin-4-yloxy)-pyridine and (4-bromomethyl-phenyl)-acetonitrile.

Yield: 0.91 g (49.8 % of theory)

C<sub>19</sub>H<sub>21</sub>N<sub>3</sub>O (M= 307.39)

20 calc.: molar peak (M+H)<sup>+</sup>: 308 fnd.: molar peak (M+H)<sup>+</sup>: 308

R<sub>f</sub> value: 0.49 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

1.26.b 2-{4-[4-(pyridin-2-yloxy)-piperidin-1-ylmethyl]-phenyl}-ethylamine

Prepared analogously to Example 1.1.h from {4-[4-(pyridin-2-yloxy)-piperidin-1-

25 ylmethyl]-phenyl}-acetonitrile

Yield: 0.92 g (99.8 % of theory)

C<sub>19</sub>H<sub>25</sub>N<sub>3</sub>O (M= 311.43)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 312      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 312

$R_f$  value: 0.16 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

1.26.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-(2-{4-[4-(pyridin-2-yloxy)-5-piperidin-1-ylmethyl]-phenyl}-ethyl)-amide

Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-{4-[4-(pyridin-2-yloxy)-piperidin-1-ylmethyl]-phenyl}-ethylamine

Yield: 0.8 g (97.2 % of theory)



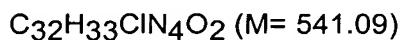
10 calc.: molar peak ( $M+H$ )<sup>+</sup>: 571/573      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 571/573

$R_f$  value: 0.52 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

1.26.d 4'-chloro-3-amino-biphenyl-4-carboxylic acid-(2-{4-[4-(pyridin-2-yloxy)-piperidin-1-ylmethyl]-phenyl}-ethyl)-amide

15 Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-(2-{4-[4-(pyridin-2-yloxy)-piperidin-1-ylmethyl]-phenyl}-ethyl)-amide

Yield: 0.38 g (50 % of theory)

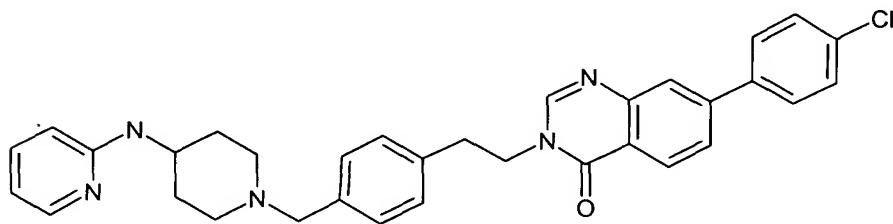


calc.: molar peak ( $M+H$ )<sup>+</sup>: 541/543      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 541/543

20  $R_f$  value: 0.5 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

**Example 1.27:**

7-(4-chloro-phenyl)-3-(2-{4-[4-(pyridin-2-ylamino)-piperidin-1-ylmethyl]-phenyl}-ethyl)-3*H*-quinazolin-4-one



25

1.27.a {4-[4-(pyridin-2-ylamino)-piperidin-1-ylmethyl]-phenyl}-acetonitrile

Prepared analogously to Example 1.1.g from 2-(piperidin-4-ylamino)-pyridine and (4-bromomethyl-phenyl)-acetonitrile.

Yield: 1.57 g (86.1 % of theory)

C<sub>19</sub>H<sub>22</sub>N<sub>4</sub> (M= 306.41)

5 calc.: molar peak (M+H)<sup>+</sup>: 307      fnd.: molar peak (M+H)<sup>+</sup>: 307

R<sub>f</sub> value: 0.43 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

1.27.b 2-{4-[4-(pyridin-2-ylamino)-piperidin-1-ylmethyl]-phenyl}-ethylamine

Prepared analogously to Example 1.1.h from {4-[4-(pyridin-2-ylamino)-piperidin-1-ylmethyl]-phenyl}-acetonitrile

10 Yield: 1.62 g (99.8 % of theory)

C<sub>19</sub>H<sub>26</sub>N<sub>4</sub> (M= 310.44)

calc.: molar peak (M+H)<sup>+</sup>: 311      fnd.: molar peak (M+H)<sup>+</sup>: 311

R<sub>f</sub> value: 0.1 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

15

1.27.c 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-(2-{4-[4-(pyridin-2-ylamino)-piperidin-1-ylmethyl]-phenyl}-ethyl)-amide

Prepared analogously to Example 1.1.i from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid and 2-{4-[4-(pyridin-2-ylamino)-piperidin-1-ylmethyl]-phenyl}-ethylamine

20 Yield: 0.36 g (43.8 % of theory)

C<sub>32</sub>H<sub>32</sub>CIN<sub>5</sub>O<sub>3</sub> (M= 570.09)

calc.: molar peak (M+H)<sup>+</sup>: 570/572      fnd.: molar peak (M+H)<sup>+</sup>: 570/572

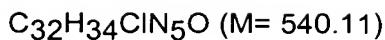
R<sub>f</sub> value: 0.28 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

25

1.27.d 4'-chloro-3-amino-biphenyl-4-carboxylic acid-(2-{4-[4-(pyridin-2-ylamino)-piperidin-1-ylmethyl]-phenyl}-ethyl)-amide

Prepared analogously to Example 1.3.c from 4'-chloro-3-nitro-biphenyl-4-carboxylic acid-(2-{4-[4-(pyridin-2-ylamino)-piperidin-1-ylmethyl]-phenyl}-ethyl)-amide

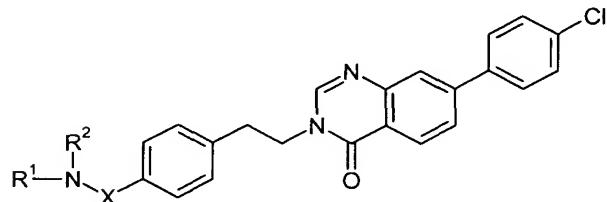
30 Yield: 0.29g (85.7 % of theory)



calc.: molar peak  $(\text{M}+\text{H})^+$ : 540/542      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 540/542

$R_f$  value: 0.27 (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)

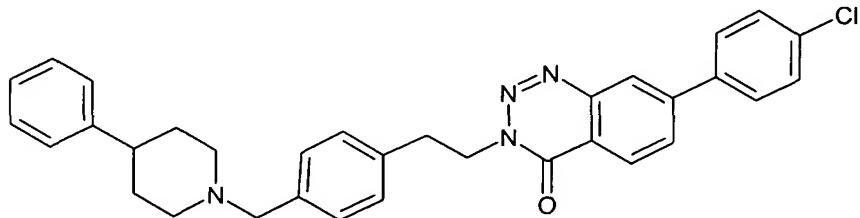
- 5 The following compounds were prepared analogously to Example 1.1.k:



| Example | $\text{R}^1\text{R}^2\text{-N-X-}$ | educt  | empirical formula                                  | mass spectrum                      | mp [°C]     | $R_f$ value |
|---------|------------------------------------|--------|--|------------------------------------|-------------|-------------|
| 1.21    |                                    | 1.21.d | $\text{C}_{34}\text{H}_{32}\text{ClN}_3\text{O}$   | 534/536<br>$[\text{M}+\text{H}]^+$ | 178-<br>179 | 0.72<br>(E) |
| 1.22    |                                    | 1.22.d | $\text{C}_{33}\text{H}_{31}\text{ClN}_4\text{O}$   | 535/537<br>$[\text{M}+\text{H}]^+$ | 199-<br>200 |             |
| 1.23    |                                    | 1.23.d | $\text{C}_{34}\text{H}_{32}\text{ClN}_3\text{O}_2$ | 550/552<br>$[\text{M}+\text{H}]^+$ | 204-<br>205 | 0.46<br>(F) |
| 1.24    |                                    | 1.23.d | $\text{C}_{34}\text{H}_{30}\text{ClN}_3\text{O}$   | 532/534<br>$[\text{M}+\text{H}]^+$ | 166-<br>167 | 0.57<br>(E) |
| 1.25    |                                    | 1.25.d | $\text{C}_{33}\text{H}_{36}\text{ClN}_3\text{O}$   | 526/528<br>$[\text{M}+\text{H}]^+$ | 184-<br>185 | 0.62<br>(E) |
| 1.26    |                                    | 1.26.d | $\text{C}_{33}\text{H}_{31}\text{ClN}_4\text{O}_2$ | 551/553<br>$[\text{M}+\text{H}]^+$ | 154-<br>158 | 0.46<br>(A) |
| 1.27    |                                    | 1.27.d | $\text{C}_{33}\text{H}_{32}\text{ClN}_5\text{O}$   | 550/552<br>$[\text{M}+\text{H}]^+$ | 164-<br>166 | 0.45<br>(A) |

R<sub>f</sub> value: A= (silica gel, dichloromethane/methanol/ammonia 9:1:0.1)  
E= (silica gel, dichloromethane/ethanol 10:1)  
F= (silica gel, dichloromethane/ethanol/ammonia 10:1:0.1)

- 5   **Example 1.28**           7-(4-chloro-phenyl)-3-{2-[4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-benzo[*d*][1,2,3]triazin-4-one

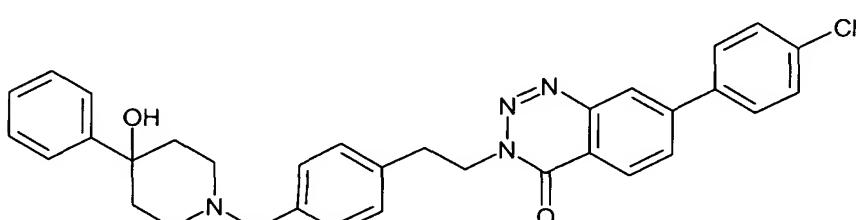


1.28.a 7-(4-chloro-phenyl)-3-{2-[4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-benzo[*d*][1,2,3]triazin-4-one

- 10   Prepared analogously to Example 1.18.a from 4'-chloro-3-amino-biphenyl-4-carboxylic acid-(2-[4-(4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl)-amide.  
Yield: 0.13 g (50.9 % of theory)  
melting point: 183-184°C  
C<sub>33</sub>H<sub>31</sub>CIN<sub>4</sub>O (M= 535.09)

- 15   calc.: molar peak (M+H)<sup>+</sup>: 535/537            fnd.: molar peak (M+H)<sup>+</sup>: 535/537  
R<sub>f</sub> value: 0.66 (silica gel, dichloromethane/ethanol 10:1)

**Example 1.29** 7-(4-chloro-phenyl)-3-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-benzo[*d*][1,2,3]triazin-4-one



- 20   1.29.a 7-(4-chloro-phenyl)-3-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-3*H*-benzo[*d*][1,2,3]triazin-4-one

Prepared analogously to Example 1.18.a from 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[4-(4-hydroxy-4-phenyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide.

Yield: 0.21 g (68.7 % of theory)

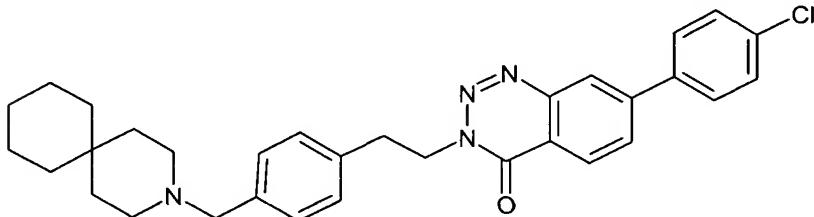
5 melting point: 265-266°C

C<sub>33</sub>H<sub>31</sub>ClN<sub>4</sub>O<sub>2</sub> (M= 551.09)

calc.: molar peak (M+H)<sup>+</sup>: 551/553      fnd.: molar peak (M+H)<sup>+</sup>: 551/553

R<sub>f</sub> value: 0.53 (silica gel, dichloromethane/ethanol 10:1)

- 10 **Example 1.30** 7-(4-chloro-phenyl)-3-{2-[4-(3-aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethyl}-3*H*-benzo[d][1,2,3]triazin-4-one



1.30.a 7-(4-chloro-phenyl)-3-{2-[4-(3-aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethyl}-3*H*-benzo[d][1,2,3]triazin-4-one

- 15 Prepared analogously to Example 1.18.a from 4'-chloro-3-amino-biphenyl-4-carboxylic acid-{2-[4-(3-aza-spiro[5.5]undec-3-ylmethyl)-phenyl]-ethyl}-amide.

Yield: 0.14 g (54.9 % of theory)

melting point: 165-166°C

C<sub>32</sub>H<sub>35</sub>ClN<sub>4</sub>O (M= 527.11)

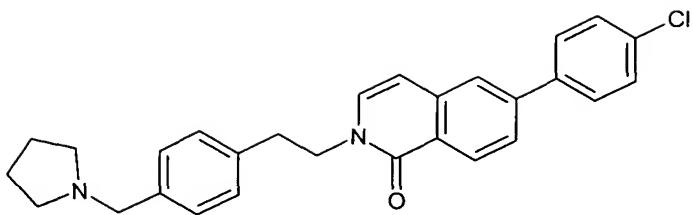
20 calc.: molar peak (M+H)<sup>+</sup>: 527      fnd.: molar peak (M+H)<sup>+</sup>: 527

R<sub>f</sub> value: 0.56 (silica gel, dichloromethane/ethanol 10:1)

**Example 1.31:**

6-(4-chloro-phenyl)-2-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-2*H*-isoquinolin-1-

- 25 one



1.31.a. 2-[2-(4-bromo-phenyl)-ethoxy]-tetrahydro-pyran

0.025 g of p-toluenesulphonic acid and 2.575 ml (28.22 mmol) of dihydropyran are  
5 added successively to a solution of 4.83 g (24.02 mmol) of 2-(4-bromo-phenyl)-ethanol in 12 ml dichloromethane at 0°C. Then the reaction mixture is stirred for three hours at ambient temperature. The reaction mixture is extracted with sodium hydrogen carbonate solution and the organic phase is dried over sodium sulphate. The purification is carried out by column chromatography on Alox (eluant:  
10 cyclohexane/ ethyl acetate= 8:2).

Yield: 37 g (32.8 % of theory)

C<sub>13</sub>H<sub>17</sub>BrO<sub>2</sub> (M= 285.18)

calc.: molar peak (M)<sup>+</sup>: 284/286      fnd.: molar peak (M)<sup>+</sup>: 284/286

15 1.31.b 4-[2-(tetrahydro-pyran-2-yloxy)-ethyl]-benzaldehyde

11.5 ml (18.41 mmol) of a 1.6 M n-butyllithium solution are added dropwise to a solution of 5 g (17.53 mmol) of 2-[2-(4-bromo-phenyl)-ethoxy]-tetrahydro-pyran in 80 ml of tetrahydrofuran at -70°C and stirred for one hour at this temperature. Then 2.8 ml (36.46 mmol) of dimethylformamide are added dropwise and the  
20 reaction mixture is stirred for another two hours at -70°C. The reaction mixture is combined with ammonium chloride solution and extracted with ethyl acetate. The combined organic phases are extracted three times with saturated sodium chloride solution and dried over sodium sulphate. The purification is carried out by column chromatography on silica gel (eluant: cyclohexane/ ethyl acetate= 6:4).

25 Yield: 2.8 g (68.2 % of theory)

C<sub>14</sub>H<sub>18</sub>O<sub>3</sub> (M= 234.29)

calc.: molar peak (M+H)<sup>+</sup>: 235      fnd.: molar peak (M+H)<sup>+</sup>: 235

R<sub>f</sub> value: 0.57 (silica gel, petroleum ether/ethyl acetate 3:1)

1.31.c 4-(2-hydroxy-ethyl)-benzaldehyde

5 A solution of 2.8 g (11.95 mmol) of 4-[2-(tetrahydro-pyran-2-yloxy)-ethyl]-benzaldehyde in a mixture of 48 ml 1M hydrochloric acid and 60 ml acetone is stirred for five hours at 5°C. The reaction mixture is combined with 140 ml saturated sodium hydrogen carbonate solution and extracted with ethyl acetate. The combined organic phases are extracted three times with water and dried over 10 sodium sulphate. The purification is carried out by column chromatography on silica gel (eluant: cyclohexane/ ethyl acetate= 1:1).

Yield: 1.3 g (72.4 % of theory)

C<sub>9</sub>H<sub>10</sub>O<sub>2</sub> (M= 150.17)

calc.: molar peak (M+H)<sup>+</sup>: 151      fnd.: molar peak (M+H)<sup>+</sup>: 151

15 R<sub>f</sub> value: 0.52 (silica gel, petroleum ether/ethyl acetate 1:1)

1.31.d 2-(4-[1.3]dioxane-2-yl-phenyl)-ethanol

A suspension of 9.4 g (62.59 mmol) of 4-(2-hydroxy-ethyl)-benzaldehyde, 15.83 ml (219.07 mmol) of 1,3-propanediol, 0.3 g p-toluenesulphonic acid and 150 ml of 20 toluene is refluxed for three hours. The reaction mixture is extracted three times with saturated sodium hydrogen carbonate solution and the organic phase is dried over sodium sulphate.

Yield: 8 g (61.4 % of theory)

C<sub>12</sub>H<sub>16</sub>O<sub>3</sub> (M= 208.26)

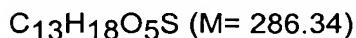
25 calc.: molar peak (M+H)<sup>+</sup>: 209      fnd.: molar peak (M+H)<sup>+</sup>: 209

1.31.e methanesulphonic acid-2-(4-[1.3]dioxan-2-yl-phenyl)-ethyl ester

8 g (38.41 mmol) of 2-(4-[1.3]dioxan-2-yl-phenyl)-ethanol and 10.65 ml (42.25 mmol) of triethylamine are dissolved in 300 ml dichloromethane and at 0°C 30 combined with 3.27 ml methanesulphonic acid chloride, dissolved in 50 ml

dichloromethane. The reaction mixture is stirred for one hour at ambient temperature, extracted three times with water and the organic phase is dried over sodium sulphate. The purification is carried out by column chromatography on silica gel (eluant: petroleum ether/ ethyl acetate= 1:1).

5 Yield: 7.7 g (70 % of theory)



calc.: molar peak ( $M+H$ ) $^+$ : 287      fnd.: molar peak ( $M+H$ ) $^+$ : 287

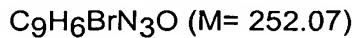
$R_f$  value: 0.49 (silica gel, petroleum ether/ethyl acetate 1:1)

10 1.31.f (E)-3-(3-bromo-phenyl)-acryloylazide

To a solution of 25 g (111.1 mmol) of (E)-3-(3-bromo-phenyl)-acrylic acid and 15.26 ml (110.10 mmol) of triethylamine in 800 ml acetone are added dropwise at 0°C 11.5 ml (121.11 mmol) of ethyl chloroformate. After one hour 11.45 g (176.16 mmol) of sodium azide, dissolved in 88 ml of distilled water, are also added

15 dropwise at 0°C. The reaction mixture is allowed to warm up to ambient temperature and then poured onto 1.3 l of ice water. The precipitate formed is filtered off, washed with water and dried at 30°C in the circulating air dryer.

Yield: 21.1 g (76.1 % of theory)



20 calc.: molar peak ( $M+H$ ) $^+$ : 256/258      fnd.: molar peak ( $M+H$ ) $^+$ : 256/258

$R_f$  value: 0.85 (silica gel, petroleum ether/ethyl acetate 1:1)

1.31.g 6-bromo-2*H*-isoquinolin-1-one

25 150 g biphenylether and 7.08 ml (29.75 mmol) of tributylamine are heated to 100°C. At this temperature 5 g (19.83 mmol) of (E)-3-(3-bromo-phenyl)-acryloylazide are added and then heated to 195-205°C for two hours. Then the reaction mixture is left to cool and poured into cooled n-hexane. The precipitate is filtered off and washed with a mixture of cooled n-hexane and diethyl ether. Then the solid is dried in the circulating air dryer at 50°C. The solid is stirred with a mixture of diisopropylether and ethyl acetate and the drying process is repeated.

Yield: 0.6 g (13.5 % of theory)

C<sub>9</sub>H<sub>6</sub>BrN<sub>3</sub>O (M= 224.05)

calc.: molar peak (M+H)<sup>+</sup>: 224/226      fnd.: molar peak (M+H)<sup>+</sup>: 224/226

5    1.31.h 6-(4-chloro-phenyl)-2*H*-isoquinolin-1-one

A reaction mixture of 0.57 g (2.54 mmol) of 6-bromo-2*H*-isoquinolin-1-one, 0.398 g (2.54 mmol) of 4-chlorophenylboric acid, 2.6 ml of a 2M sodium carbonate solution in 20 ml dioxane and 5 ml of methanol is heated to 110°C for two hours in the microwave. Then the reaction mixture is poured into water, the precipitate filtered off and dried in the circulating air dryer at 40°C.

10    Yield: 0.42 g (64.6 % of theory)

C<sub>15</sub>H<sub>10</sub>CINO (M= 255.70)

calc.: molar peak (M+H)<sup>+</sup>: 256/258      fnd.: molar peak (M+H)<sup>+</sup>: 256/258

R<sub>f</sub> value: 0.6 (silica gel, dichloromethane/ethanol 10:1)

15

1.31.i 2-[2-(4-formyl-phenyl)-ethyl]-6-(4-chloro-phenyl)-2*H*-isoquinolin-1-one

A solution of 0.41 g (1.6 mmol) of 6-(4-chloro-phenyl)-2*H*-isoquinolin-1-one in 10 ml of dimethylformamide is combined with 0.18 g (1.6 mmol) of potassium tert.butoxide and stirred for 30 minutes at 50°C. Then 0.46 g (1.6 mmol) of methanesulphonic acid-2-(4-[1.3]dioxan-2-yl-phenyl)-ethyl ester is added. The reaction mixture is heated in the microwave for five hours at 180°C and then poured onto a 10% citric acid solution. It is extracted with ethyl acetate. The organic phase is extracted three times with water and dried over sodium sulphate. The purification is carried out by column chromatography on silica gel (eluant: petroleum ether/ ethyl acetate= 3:1 to 1:1).

25    Yield: 0.15 g (24.1 % of theory)

C<sub>24</sub>H<sub>18</sub>CINO<sub>2</sub> (M= 387.87)

calc.: molar peak (M+H)<sup>+</sup>: 388/390      fnd.: molar peak (M+H)<sup>+</sup>: 388/390

R<sub>f</sub> value: 0.7 (silica gel, petroleum ether/ethyl acetate 1:1)

30

1.31.j 6-(4-chloro-phenyl)-2-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-2*H*-isoquinolin-1-one

0.14 g (0.36 mmol) of 2-[2-(4-formyl-phenyl)-ethyl]-6-(4-chloro-phenyl)-2*H*-isoquinolin-1-one and 0.03 ml (0.36 mmol) of pyrrolidine are dissolved in 40 ml

5 dichloromethane. The pH is adjusted to three with glacial acetic acid. Then 0.076 g (0.36 mmol) of sodium triacetoxyborohydride are added and the mixture is stirred for 48 hours at ambient temperature. Then the reaction mixture is extracted with 2M sodium carbonate solution and dried over sodium sulphate. The purification is carried out by column chromatography on silica gel (eluant:

10 dichloromethane/ethanol 10:1 to 1:1).

Yield: 0.04 g (25 % of theory)

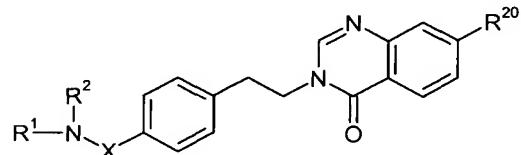
melting point: 136-137°C

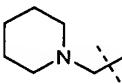
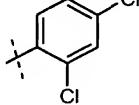
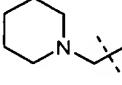
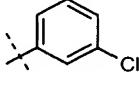
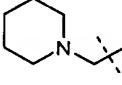
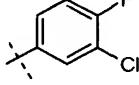
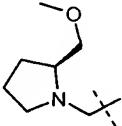
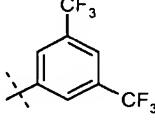
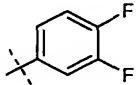
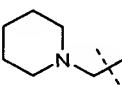
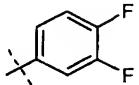
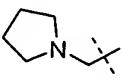
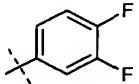
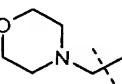
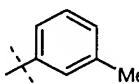
C<sub>28</sub>H<sub>27</sub>ClN<sub>2</sub>O (M= 442.99)

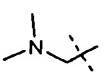
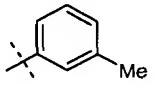
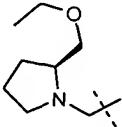
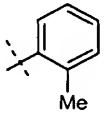
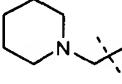
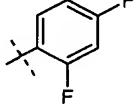
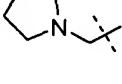
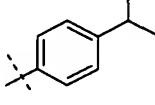
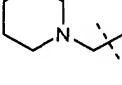
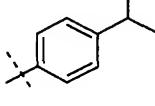
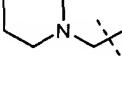
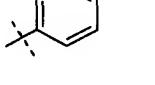
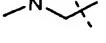
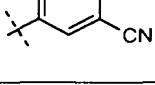
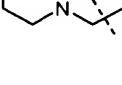
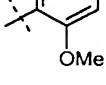
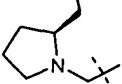
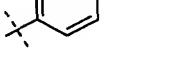
calc.: molar peak (M+H)<sup>+</sup>: 443 fnd.: molar peak (M+H)<sup>+</sup>: 443

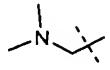
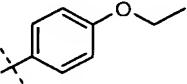
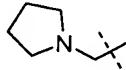
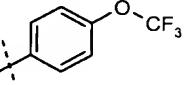
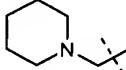
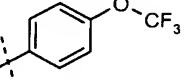
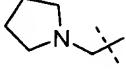
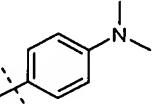
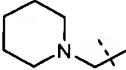
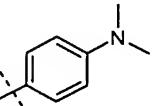
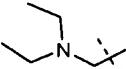
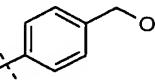
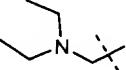
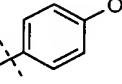
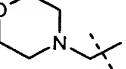
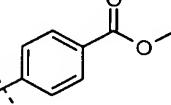
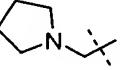
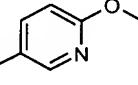
15 R<sub>f</sub> value: 0.5 (silica gel, dichloromethane/methanol 10:1)

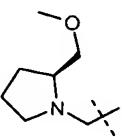
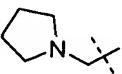
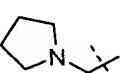
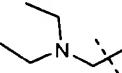
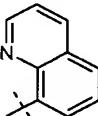
The following compounds are prepared analogously to Examples 1.1 to 1.31:



| Example | $R^1R^2N-X-$  | $R^{20}$   |
|---------|---|--|
| 1.32    |    |    |
| 1.33    |    |    |
| 1.34    |    |    |
| 1.35    |    |    |
| 1.36    |   |   |
| 1.37    |  |  |
| 1.38    |  |  |
| 1.39    |  |  |
| 1.40    |  |  |

|      |   |  |
|------|---|--|
| 1.41 |    |    |
| 1.42 |    |    |
| 1.43 |    |    |
| 1.44 |    |    |
| 1.45 |   |   |
| 1.46 |  |  |
| 1.47 |  |  |
| 1.48 |  |  |
| 1.49 |  |  |

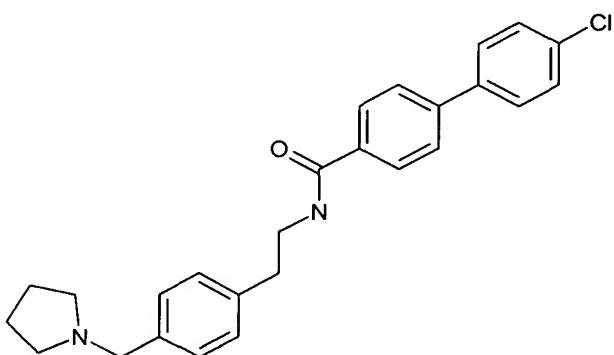
|      |   |  |
|------|---|--|
| 1.50 |    |    |
| 1.51 |    |    |
| 1.52 |    |    |
| 1.53 |    |    |
| 1.54 |    |    |
| 1.55 |  |  |
| 1.56 |  |  |
| 1.57 |  |  |
| 1.58 |  |  |

|      |   |  |
|------|---|--|
| 1.59 |  |  |
| 1.60 |  |  |
| 1.61 |  |  |
| 1.62 |  |  |

**Example 2.1:**

4'-chloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-

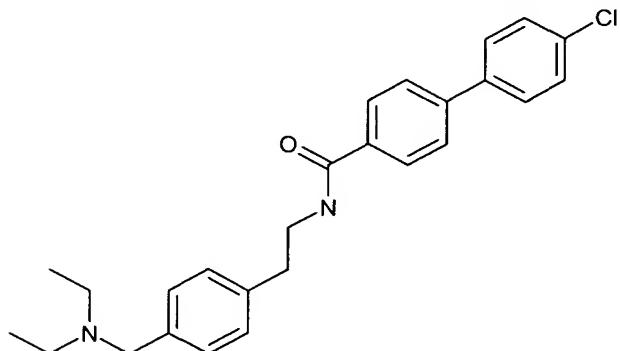
5 amide

**2.1.a 4'-chloro-biphenyl-4-carboxylic acid**5.83 g (29.0 mmol) of 4-bromo-benzoic acid is dissolved in 50 mL dioxane and 29  
10 mL 2M sodium carbonate solution. 4.5 g (29.0 mmol) of 4-chlorophenylboric acid

- and 1.68 g (1.45 mmol) of tetrakis-(triphenylphosphine)-palladium are added successively and the reaction is refluxed for 6 h. The hot reaction solution is suction filtered through a glass fibre filter. The filtrate is extracted with ethyl acetate. The aqueous phase is acidified with citric acid and stirred for one hour at 5 °C. The precipitate formed is filtered off, washed with water and dried in vacuo.  
Yield: 5.1 g (75.6 % of theory)  
 $C_{13}H_9ClO_2$  ( $M= 232.668$ )  
calc.: molar peak ( $M-H^-$ ): 231/233      fnd.: molar peak ( $M-H^-$ ): 231/233.
- 10 2.1.b. 4'-chloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide  
471 mg (1.47 mmol) of TBTU and 0.26 mL (1.47 mmol) of Hünig base are added to a suspension of 251 mg (1.08 mmol) of 4'-chloro-biphenyl-4-carboxylic acid in 5 mL THF at ambient temperature. The reaction mixture is stirred for 10 min and 15 then 200 mg (0.98 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (cf. Example 1.1.h) are added. The mixture is stirred overnight. The reaction solution is combined with saturated  $NaHCO_3$  solution, the aqueous phase is extracted with ethyl acetate and the organic phase is dried over magnesium sulphate. The solvent is distilled off using the rotary evaporator and the residue is stirred with 20 *tert*-butylmethylether while heating. The solid formed is filtered off, washed with a little *tert*-butylmethylether and dried in the air.  
Yield: 210 mg (51.2 % of theory)  
 $C_{26}H_{27}ClN_2O$  ( $M= 418.971$ )  
calc.: molar peak ( $M+H^+$ ): 419/421      fnd.: molar peak ( $M+H^+$ ): 419/421  
25  $R_f$  value: 0.57 (silica gel, dichloromethane/methanol/acetic acid 9:1: 0.1).

**Example 2.2:**

4'-chloro-biphenyl-4-carboxylic acid-[2-(4-diethylaminomethyl-phenyl)-ethyl]-amide



5

2.2.a (4-diethylaminomethyl-phenyl)-acetonitrile

0.88 mL (8.38 mmol) of diethylamine is dissolved in 30 mL acetone and 2.1 g (15.2 mmol) of potassium carbonate and 1.6 g (7.62 mmol) of (4-bromomethyl-phenyl)-acetonitrile are successively added (cf. 1.1.f). The reaction mixture is  
10 stirred for 2 h at ambient temperature, filtered through a glass frit and washed with ethyl acetate. The filtrate is evaporated down in the rotary evaporator, extracted with water and ethyl acetate. The organic phase is dried over magnesium sulphate and the solvent is removed using the rotary evaporator. Further purification is carried out by column chromatography on silica gel (eluent:  
15 dichloromethane/methanol 9:1).

Yield: 900 mg (58.4 % of theory)

C<sub>13</sub>H<sub>18</sub>N<sub>2</sub> (M= 202.30)

calc.: molar peak (M+H)<sup>+</sup>: 203      fnd.: molar peak (M+H)<sup>+</sup>: 203

R<sub>f</sub> value: 0.65 (silica gel, dichloromethane/methanol 9:1).

20

2.2.b. 2-(4-diethylaminomethyl-phenyl)-ethylamine

A solution of 900 mg (4.45 mmol) of (4-diethylaminomethyl-phenyl)-acetonitrile in 20 mL methanolic ammonia solution is combined with 100 mg of Raney nickel and

shaken at 50°C and 5 bar in the autoclave. After the catalyst has been removed by suction filtering the solvent is removed using the rotary evaporator.

Yield: 900 mg (98.0 % of theory)

C<sub>13</sub>H<sub>22</sub>N<sub>2</sub> (M= 206.334)

5 calc.: molar peak (M+H)<sup>+</sup>: 207      fnd.: molar peak (M+H)<sup>+</sup>: 207

R<sub>f</sub> value: 0.12 (silica gel, dichloromethane/methanol/NH<sub>3</sub> 9:1:0.1).

2.2.c. 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-diethylaminomethyl-phenyl)-ethyl]-amide

10 Prepared analogously to Example 2.1.b from 4'-chloro-biphenyl-4-carboxylic acid (248 mg, 1.07 mmol) and 2-(4-diethylaminomethyl-phenyl)-ethylamine (200 mg, 0.97 mmol).

Yield: 280 mg (68.6 % of theory)

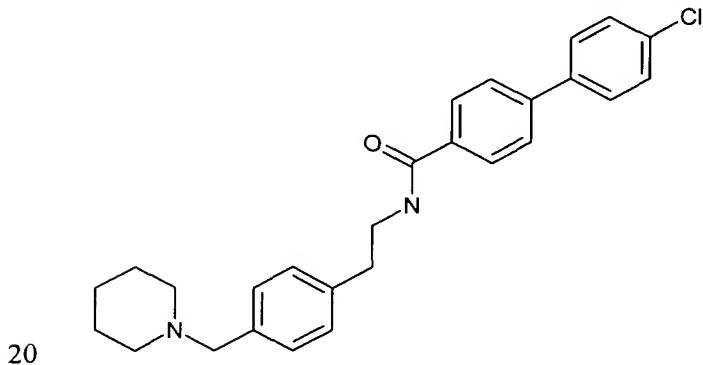
C<sub>26</sub>H<sub>29</sub>CIN<sub>2</sub>O (M= 420.987)

15 calc.: molar peak (M+H)<sup>+</sup>: 421/423      fnd.: molar peak (M+H)<sup>+</sup>: 421/423

R<sub>f</sub> value: 0.49 (silica gel, dichloromethane/methanol/NH<sub>3</sub> 9:1:0.1).

### Example 2.3:

4'-chloro-biphenyl-4-carboxylic acid-[2-(4-piperidin-1-ylmethyl-phenyl)-ethyl]-amide



2.3.a. 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-piperidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared analogously to Example 2.1.b from 4'-chloro-biphenyl-4-carboxylic acid (234 mg, 1.01 mmol) and 2-(4-piperidin-1-ylmethyl-phenyl)-ethylamine (cf. 1.15.b, 200 mg, 0.92 mmol).

Yield: 260 mg (65.6 % of theory)

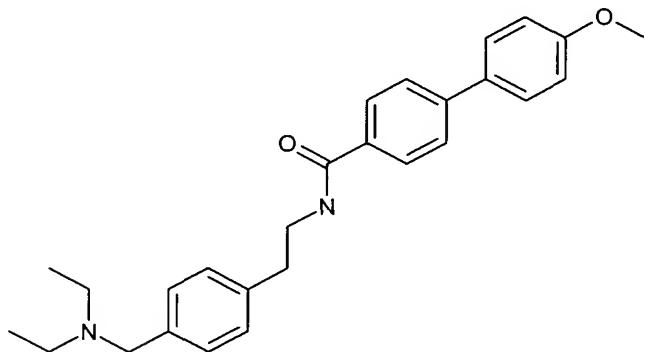
5 C<sub>27</sub>H<sub>29</sub>CIN<sub>2</sub>O (M= 432.998)

calc.: molar peak (M+H)<sup>+</sup>: 433/435      fnd.: molar peak (M+H)<sup>+</sup>: 433/435

R<sub>f</sub> value: 0.57 (silica gel, dichloromethane/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.4:**

10 4'-methoxy-biphenyl-4-carboxylic acid-[2-(4-diethylaminomethyl-phenyl)-ethyl]-amide



**2.4.a 1-(4'-methoxy-biphenyl-4-yl)-ethanone**

15 4-methoxybiphenyl is added to a solution of 11.3 g (85.0 mmol) of aluminium chloride in 100 mL of carbon disulphide. The mixture is heated to 40°C and then very slowly 6.07 ml (81.4 mmol) of acetyl chloride are added. The reaction is refluxed for one hour. After cooling the reaction solution is added to 100 g of ice and 25 mL conc. hydrochloric acid. After extraction with dichloromethane the  
20 organic phase is dried over magnesium sulphate. The solvent is eliminated using the rotary evaporator and the residue is recrystallised from isopropanol.

Yield: 8.8 g (48.0 % of theory)

C<sub>15</sub>H<sub>14</sub>O<sub>2</sub> (M= 226.278)

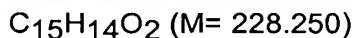
calc.: molar peak (M+H)<sup>+</sup>: 227      fnd.: molar peak (M+H)<sup>+</sup>: 227

2.4.b 4'-methoxy-biphenyl-4-carboxylic acid

6.0 mL (117 mmol) of bromine is slowly added dropwise to a solution of 15.6 g (390.9 mmol) of NaOH in 70 mL water at 0°C. Then 8.8 g (39.1 mmol) of 1-(4'-methoxy-biphenyl-4-yl)-ethanone in 50 mL dioxane is slowly added. After three

- 5 hours the solid formed is filtered off, taken up in dichloromethane and filtered again. The filtrate is freed from solvent using the rotary evaporator.

Yield: 9.0 g (100.0 % of theory)



calc.: molar peak (M-H)<sup>-</sup>: 227      fnd.: molar peak (M-H)<sup>-</sup>: 227

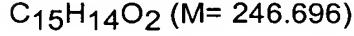
10

2.4.c 4'-methoxy-biphenyl-4-carboxylic acid chloride

A solution of 3.0 g (0.013 mol) of 4'-methoxy-biphenyl-4-carboxylic acid in 47.4 mL (0.65 mol) of thionyl chloride is stirred at 50°C for three hours. After removal of thionyl chloride using the rotary evaporator the product is obtained as a yellowish

- 15 solid, which is stored in the refrigerator.

Yield: 3.2 g (99.8 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 246/248      fnd.: molar peak (M+H)<sup>+</sup>: 246/248.

20 2.4.d 4'-methoxy-biphenyl-4-carboxylic acid-[2-(4-diethylaminomethyl-phenyl)-ethyl]-amide

287 mg (1.16 mmol) of acid chloride is added at 0°C to a solution of 200 mg (0.97 mmol) of 2-(4-diethylaminomethyl-phenyl)-ethylamine and 0.25 mL (1.45 mmol) of Hünig base in 5 mL dichloromethane. The reaction is stirred overnight and then 25 combined with semisaturated NaHCO<sub>3</sub> solution. The aqueous phase is washed with dichloromethane and the combined organic phase is dried over magnesium sulphate. After elimination of the solvent using the rotary evaporator the residue is triturated with *tert*-butylmethylether and the solid formed is suction filtered.

Yield: 90 mg (22.3 % of theory)

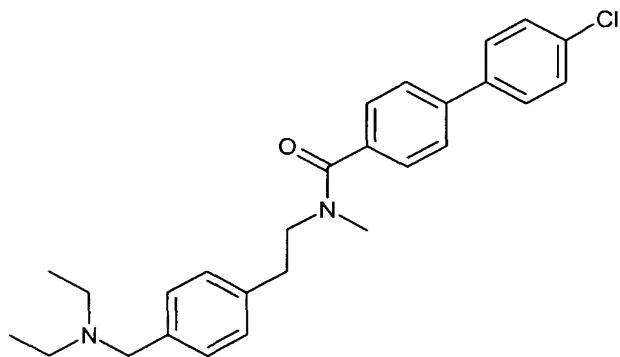
30 C<sub>27</sub>H<sub>32</sub>N<sub>2</sub>O<sub>2</sub> (M= 416.568)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 417      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 417.

$R_f$  value: 0.46 (silica gel, ethyl acetate/methanol/ $NH_3$  9:1:0.1).

**Example 2.5.**

- 5 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-diethylaminomethyl-phenyl)-ethyl]-methyl-amide



2.5.a Tert-butyl [2-(4-diethylaminomethyl-phenyl)-ethyl]-carbaminate

- 10 815 mg (3.73 mmol) of BOC-anhydride is added to a solution of 700 mg (3.93 mmol) of 2-(4-diethylaminomethyl-phenyl)-ethylamine in 5.0 mL dichloromethane and 0.52 mL (3.73 mmol) of triethylamine and stirred overnight at ambient temperature. The mixture is combined with saturated  $NaHCO_3$  solution. The aqueous phase is washed with dichloromethane and the organic phase is dried over magnesium sulphate. After elimination of the solvent using the rotary evaporator the residue is purified by column chromatography on silica gel (eluent: dichloromethane/methanol/ $NH_3$  = 9:1:0.1).
- 15 Yield: 600 mg (57.7 % of theory)

$C_{18}H_{30}N_2O_2$  ( $M=306.452$ )

- 20 calc.: molar peak ( $M+H$ )<sup>+</sup>: 307      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 307.

2.5.b [2-(4-diethylaminomethyl-phenyl)-ethyl]-methyl-amine

- 600 mg (1.96 mmol) of tert-butyl [2-(4-diethylaminomethyl-phenyl)-ethyl]-carbaminate in THF is slowly added dropwise to a suspension of 250 mg (6.59 mmol) of lithium aluminium hydride in 10 mL tetrahydrofuran. The reaction is

stirred overnight and heated to 50°C for a further hour. Working up is carried out by the successive addition of 0.25 mL water, 0.25 mL 15% NaOH solution and 0.75 mL water. After filtration the organic phase is dried over magnesium sulphate and the solvent is eliminated using the rotary evaporator.

5 Yield: 350 mg (81.1 % of theory)

C<sub>14</sub>H<sub>24</sub>N<sub>2</sub> (M=220.361)

calc.: molar peak (M+H)<sup>+</sup>: 221      fnd.: molar peak (M+H)<sup>+</sup>: 221.

2.5.c 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-diethylaminomethyl-phenyl)-ethyl]-methyl-amide  
10      Prepared analogously to Example 2.1.b from 4'-chloro-biphenyl-4-carboxylic acid (222 mg, 0.95 mmol) and [2-(4-diethylaminomethyl-phenyl)-ethyl]-methyl-amine (175 mg, 0.79 mmol).

Yield: 60 mg (17.4 % of theory)

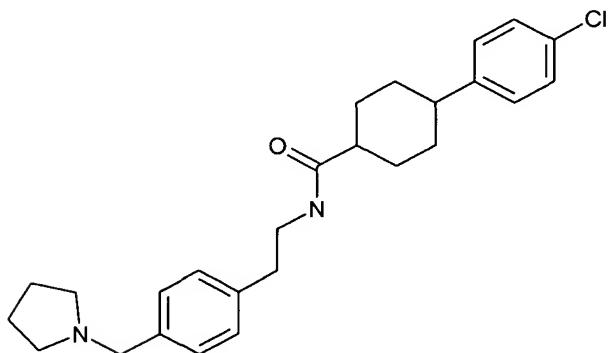
15 C<sub>27</sub>H<sub>31</sub>ClN<sub>2</sub>O (M= 435.014)

calc.: molar peak (M+H)<sup>+</sup>: 435/437      fnd.: molar peak (M+H)<sup>+</sup>: 435/437

R<sub>f</sub> value: 0.39 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.6:**

20



2.6.a. 4-(4-chloro-phenyl)-cyclohexanecarboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 4-(4-chloro-phenyl)-cyclohexanecarboxylic acid (239 mg, 1.0 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (204 mg, 1.0 mmol).

Yield: 65 mg (15.3 % of theory)

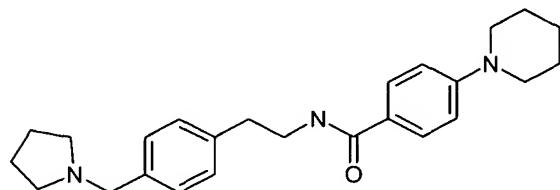
5 C<sub>26</sub>H<sub>33</sub>ClN<sub>2</sub>O (M= 425.019)

calc.: molar peak (M+H)<sup>+</sup>: 425/427      fnd.: molar peak (M+H)<sup>+</sup>: 425/427

R<sub>f</sub> value: 0.3 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.7:**

10 4-piperidin-1-yl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



2.7.a ethyl 4-piperidin-1-yl-benzoate

0.41 mL piperidine is added to a suspension of 0.5 mL (4.13 mmol) of ethyl 4-fluoro-benzoate and 571 mg (4.13 mmol) of potassium carbonate in 20 mL DMSO. The reaction mixture is stirred overnight at 70°C, a further 1 mL (2.44 mmol) of piperidine is added and stirring is continued for a further 6 h at 70°C. After filtration water is added, the mixture is extracted with ethyl acetate, the organic phase is separated off and the solvent eliminated using the rotary evaporator. The product 20 is further reacted without purification.

Yield: 706 mg (73.2 % of theory)

C<sub>14</sub>H<sub>19</sub>NO<sub>2</sub> (M= 233.313)

calc.: molar peak (M+H)<sup>+</sup>: 234      fnd.: molar peak (M+H)<sup>+</sup>: 234

Retention time HPLC: 6.2 min (method A)

25

2.7.b 4-piperidin-1-yl-benzoic acid

0.78 mL (0.74 mmol) of 2N NaOH are added to a solution of 350 mg (1.50 mmol) of ethyl 4-piperidin-1-yl-benzoate in 10 mL ethanol. The reaction solution is stirred for 2 h at 60°C and then the pH is adjusted to 6-7 with 1N HCl. The precipitate formed is dried overnight after filtration under high vacuum.

5 Yield: 158 mg (51.3 % of theory)

C<sub>12</sub>H<sub>15</sub>NO<sub>2</sub> (M= 205.259)

calc.: molar peak (M+H)<sup>+</sup>: 206      fnd.: molar peak (M+H)<sup>+</sup>: 206

Retention time HPLC: 6.2 min (method A)

10 2.7.c 4-piperidin-1-yl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (157 mg, 0.77 mmol) and 4-piperidin-1-yl-benzoic acid (158 mg, 0.77 mmol).

Yield: 102 mg (33.8 % of theory)

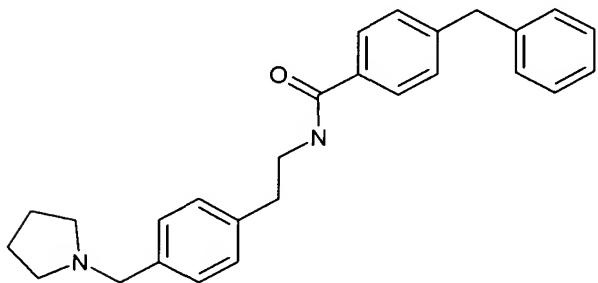
15 C<sub>25</sub>H<sub>33</sub>N<sub>3</sub>O (M= 391.561)

calc.: molar peak (M+H)<sup>+</sup>: 392      fnd.: molar peak (M+H)<sup>+</sup>: 392

Retention time HPLC: 4.4 min (method A)

**Example 2.8:**

20



2.8.a 4-benzyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

Prepared according to general working method I described hereinbefore from diphenylmethane-4-carboxylic acid (104 mg, 0.49 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (100 mg, 0.49 mmol).

Yield: 66 mg (33.9 % of theory)

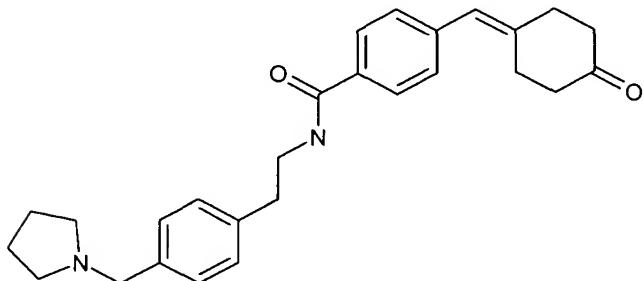
5 C<sub>27</sub>H<sub>30</sub>N<sub>2</sub>O (M= 398.553)

calc.: molar peak (M+H)<sup>+</sup>: 399      fnd.: molar peak (M+H)<sup>+</sup>: 399

R<sub>f</sub> value: 0.46 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.9:**

10 4-(4-oxo-cyclohexylidenemethyl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



2.9.a ethyl 4-(1,4-dioxa-spiro[4.5]dec-8-ylidenemethyl)-benzoate

15 350 mL (0.56 mol, 1.6 M in hexane) of n-BuLi solution is added dropwise at -20°C to a solution of 90.0 mL (0.63 mol) of diisopropylamine in 100 mL THF and the reaction solution is stirred for 30 min at -20°C. 112 g (0.37 mol) of ethyl 4-(diethoxy-phosphorylmethyl)-benzoate in 100 mL THF are slowly added dropwise. The reaction solution is stirred for 1 h at -20°C and then 58 g (0.37 mol) of 1,4-dioxa-spiro[4.5]decan-8-one in 200 mL THF are added dropwise. The reaction solution is stirred for 30 min at -12°C and then heated to ambient temperature over 2 h. Water is added, the aqueous phase is extracted with ether, ethyl acetate and dichloromethane. The organic phase is filtered through silica gel. After elimination of the solvent using the rotary evaporator the residue is purified by chromatography (silica gel, petroleum ether/ethyl acetate 9:1).

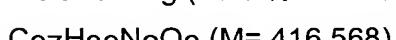
Yield: 80 g (72.0 % of theory).

2.9.b 4-(1,4-dioxa-spiro[4.5]dec-8-ylidenemethyl)-benzoic acid

- 20 g NaOH in 130 mL water are added to a solution of 35 g (0.12 mol) of ethyl 4-
- 5 (1,4-dioxa-spiro[4.5]dec-8-ylidenemethyl)-benzoate in 150 mL ethanol and the mixture is refluxed for 2 h. The reaction solution is added to 400 g of ice and 60 mL conc. hydrochloric acid, the aqueous phase is extracted with ethyl acetate and the solvent is eliminated using the rotary evaporator.
- Yield: 32 g (91.4 % of theory).
- 10 melting point: 164-165°C.

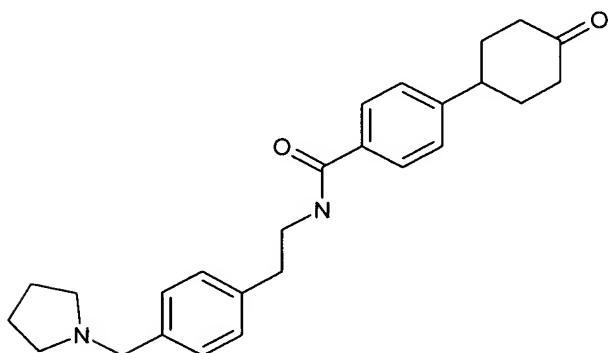
2.9.c 4-(4-oxo-cyclohexylidenemethyl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

- Prepared according to general working method I from 4-(1,4-dioxa-spiro[4.5]dec-8-ylidenemethyl)-benzoic acid (134 mg, 0.49 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (100 mg, 0.49 mmol).
- 15 Yield: 57 mg (28.0 % of theory)



- calc.: molar peak (M+H)<sup>+</sup>: 417      fnd.: molar peak (M+H)<sup>+</sup>: 417
- 20 R<sub>f</sub> value: 0.36 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.10:**



2.10.a            4-(4-oxo-cyclohexyl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

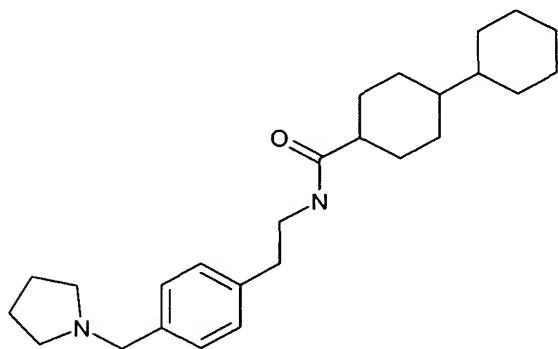
Prepared according to general working method I from 4-(4-oxo-cyclohexyl)-  
5        benzoic acid (128 mg, 0.49 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-  
ethyllamine (100 mg, 0.49 mmol).

Yield: 26 mg (13.1 % of theory)  
 $C_{26}H_{32}N_2O_2$  ( $M= 404.557$ )  
calc.: molar peak ( $M+H$ )<sup>+</sup>: 405            fnd.: molar peak ( $M+H$ )<sup>+</sup>: 405  
10       $R_f$  value: 0.31 (silica gel, ethyl acetate/methanol/ $NH_3$  9:1:0.1).

**Example 2.11:**

4-cyclohexyl-1-cyclohexylcarboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

15



2.11.a 4-cyclohexyl-1-cyclohexylcarboxylic acid  
0.44 mL conc. hydrochloric acid and 100 mg platinum oxide are added to a  
solution of 500 mg (2.10 mmol) of 4-(4-chlorophenyl)-cyclohexanecarboxylic acid  
20        in 10 mL methanol. The reaction mixture is stirred at 50°C and 5 bar hydrogen for  
3 h. After separation of the catalyst the solvent is eliminated using the rotary  
evaporator.

Yield: 440 mg (99.9 % of theory)  
 $C_{13}H_{22}O_2$  ( $M= 210.319$ )

calc.: molar peak (M-H)<sup>-</sup>: 209      fnd.: molar peak (M-H)<sup>-</sup>: 209

2.11.b 4-cyclohexyl-1-cyclohexylcarboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

- 5 Prepared according to general working method I from bicyclohexyl-4-carboxylic acid (103 mg, 0.49 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (100 mg, 0.49 mmol).

Yield: 2.0 mg (1.0 % of theory)

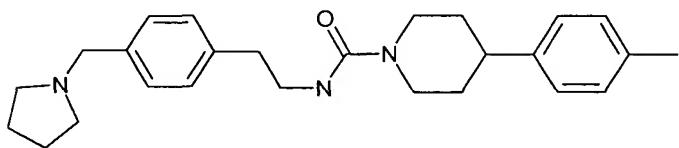
C<sub>26</sub>H<sub>40</sub>N<sub>2</sub>O (M= 396.622)

- 10 calc.: molar peak (M+H)<sup>+</sup>: 397      fnd.: molar peak (M+H)<sup>+</sup>: 397

R<sub>f</sub> value: 0.46 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.12:**

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2.12.a 4-methylphenyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

- Prepared according to general working method II described hereinbefore from 4-methylphenyl-piperidine (175 mg, 1.0 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (204 mg, 1.0 mmol).

Yield: 90.0 mg (22.2 % of theory)

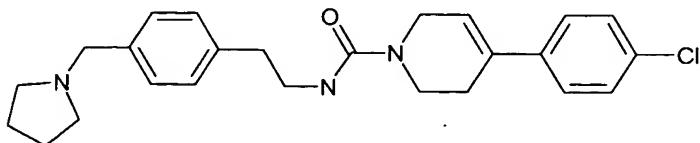
C<sub>26</sub>H<sub>35</sub>N<sub>3</sub>O (M= 405.558)

calc.: molar peak (M+H)<sup>+</sup>: 406      fnd.: molar peak (M+H)<sup>+</sup>: 406

- 25 R<sub>f</sub> value: 0.30 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.13:**

4-(4-chloro-phenyl)-3,6-dihydro-2*H*-pyridine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



5 2.13.a 4-(4-chloro-phenyl)-1,2,3,6-tetrahydro-pyridine

4-chloro-methylstyrene is added dropwise at 60°C to 100 mL (1.2 mol) of formalin solution (37% in water) and 32.1 g (0.6 mol) of ammonium chloride. The reaction mixture is stirred for 3 h at 60°C and then cooled to ambient temperature. 100 mL methanol are added and the mixture is stirred overnight. After evaporation of the solvent using the rotary evaporator the residue is combined with 150 mL conc. hydrochloric acid and stirred for 4 h at 100°C. After cooling to ambient temperature it is added to ice and made alkaline with NaOH chips. After repeated extraction with ether the organic phase is dried over sodium sulphate. After elimination of the solvent using the rotary evaporator the residue is purified by column chromatography on silica gel (eluant: ethyl acetate:methanol:NH<sub>3</sub> 9:1:0.1). Yield: 17.0 g (29.3 % of theory)

C<sub>11</sub>H<sub>12</sub>CIN (M= 193.678)

calc.: molar peak (M+H)<sup>+</sup>: 194      fnd.: molar peak (M+H)<sup>+</sup>: 194

R<sub>f</sub> value: 0.26 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 6:4:0.4).

20

2.13.b 4-(4-chloro-phenyl)-3,6-dihydro-2*H*-pyridine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-(4-chloro-phenyl)-1,2,3,6-tetrahydro-pyridine (193 mg, 1.0 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (204 mg, 1.0 mmol).

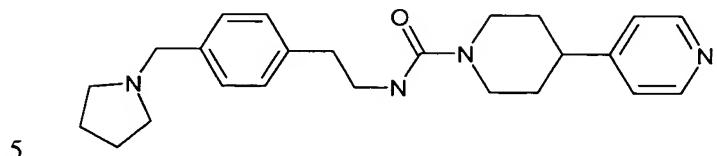
Yield: 40.0 mg (9.4 % of theory)

C<sub>25</sub>H<sub>30</sub>CIN<sub>3</sub>O (M= 423.990)

calc.: molar peak (M+H)<sup>+</sup>: 424/426      fnd.: molar peak (M+H)<sup>+</sup>: 424/426

R<sub>f</sub> value: 0.30 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.14:**



2.14.a 3,4,5,6-tetrahydro-2H-[4,4']bipyridinyl-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 1,2,3,4,5,6-hexahydro-[4,4']bipyridinyl (81 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

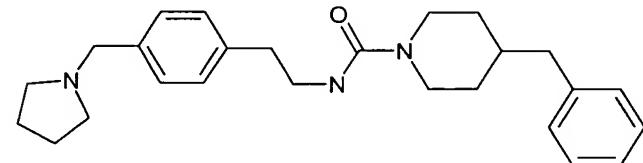
Yield: 43.8 mg (22.3 % of theory)

C<sub>24</sub>H<sub>32</sub>N<sub>4</sub>O (M= 392.549)

calc.: molar peak (M+H)<sup>+</sup>: 393      fnd.: molar peak (M+H)<sup>+</sup>: 393

15 R<sub>f</sub> value: 0.14 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.15:**



2.15.a 4-benzyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-benzyl-piperidine (87.7 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

Yield: 33.5 mg (16.5 % of theory)

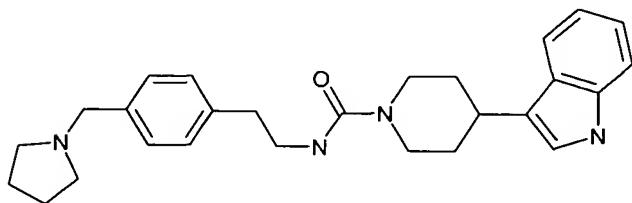
C<sub>26</sub>H<sub>35</sub>N<sub>3</sub>O (M= 405.6)

calc.: molar peak (M+H)<sup>+</sup>: 406      fnd.: molar peak (M+H)<sup>+</sup>: 406

R<sub>f</sub> value: 0.36 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

5

**Example 2.16:**



- 10 2.16.a 4-(1*H*-indol-3-yl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 3-piperidin-4-yl-1*H*-indole (100 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

- 15 Yield: 56.5 mg (26.2 % of theory)

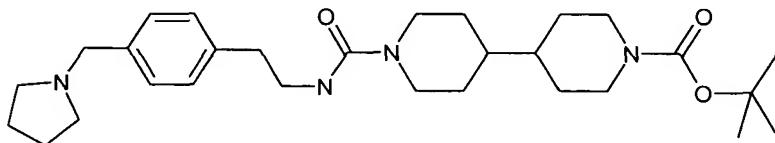
C<sub>27</sub>H<sub>34</sub>N<sub>4</sub>O (M= 430.6)

calc.: molar peak (M+H)<sup>+</sup>: 431      fnd.: molar peak (M+H)<sup>+</sup>: 431

R<sub>f</sub> value: 0.36 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

20

**Example 2.17:**

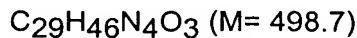


2.17.a *tert*-butyl 1'-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylcarbamoyl]-[4.4']bipiperidinyl-1-carboxylate

Prepared according to general working method II from *tert*-butyl [4.4']-bipiperidinyl-1-carboxylate (134 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-

5 ethylamine (102 mg, 0.50 mmol).

Yield: 51.0 mg (20.5 % of theory)



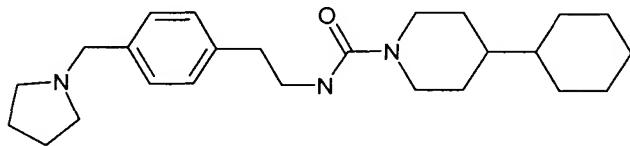
calc.: molar peak (M+H)<sup>+</sup>: 499      fnd.: molar peak (M+H)<sup>+</sup>: 499

R<sub>f</sub> value: 0.40 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

10

**Example 2.18:**

4-cyclohexyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



15

2.18.a 4-cyclohexyl-piperidine

To a solution of 1.0 g (6.4 mmol) of 4-phenylpyridin in 20 mL methanol are added 1.35 mL conc. hydrochloric acid and 200 mg platinum oxide. The reaction mixture is stirred at 50°C and 3 bar hydrogen for 2.5 h. After separation of the catalyst the

20 solvent is eliminated using the rotary evaporator, while the product is precipitated as the hydrochloride.

Yield: 1.2 (91.4 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 168      fnd.: molar peak (M+H)<sup>+</sup>: 168.

25

2.18.b 4-cyclohexyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-cyclohexyl-piperidine (83.7 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

Yield: 38.0 mg (19.1 % of theory)

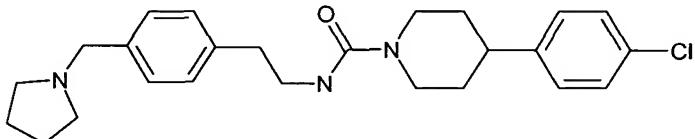
5 C<sub>25</sub>H<sub>39</sub>N<sub>3</sub>O (M= 397.6)

calc.: molar peak (M+H)<sup>+</sup>: 398      fnd.: molar peak (M+H)<sup>+</sup>: 398

R<sub>f</sub> value: 0.54 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.19:**

10 4-(4-chloro-phenyl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.19.a 4-(4-chloro-phenyl)-piperidine

15 To a solution of 5.0 g (21.7 mmol) of 4-(4-chloro-phenyl)-1,2,3,6-tetrahydro-pyridine (cf. 2.13.a) in 20 mL methanol are added 500 mg Pd/C. The reaction mixture is stirred for 7 h at ambient temperature and 10 psi hydrogen. After separation of the catalyst the solvent is eliminated using the rotary evaporator. Further purification is carried out by column chromatography on silica gel (eluent: dichloromethane/methanol/ammonia = 5:4.9:0.1).

20 Yield: 3.2 (75.3 % of theory)

C<sub>11</sub>H<sub>14</sub>CIN (M= 195.694)

calc.: molar peak (M+H)<sup>+</sup>: 196/198      fnd.: molar peak (M+H)<sup>+</sup>: 196/198.

R<sub>f</sub> value: 0.37 (silica gel, dichloromethane/methanol/NH<sub>3</sub> 5:4.9:0.1).

25

2.19.b 4-(4-chloro-phenyl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-(4-chloro-phenyl)-piperidine (97.9 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

Yield: 9.0 mg (4.2 % of theory)

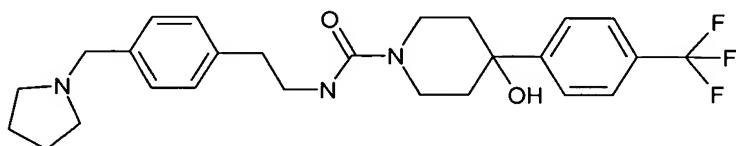
5 C<sub>25</sub>H<sub>32</sub>ClN<sub>3</sub>O (M= 426.0)

calc.: molar peak (M+H)<sup>+</sup>: 426/428      fnd.: molar peak (M+H)<sup>+</sup>: 426/428

R<sub>f</sub> value: 0.49 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

### Example 2.20:

10



2.20.a 4-hydroxy-4-(4-trifluoromethyl-phenyl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

15 Prepared according to general working method II from 4-hydroxy-4-(4-trifluoromethyl-phenyl)-piperidine (123 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

Yield: 35.0 mg (14.7 % of theory)

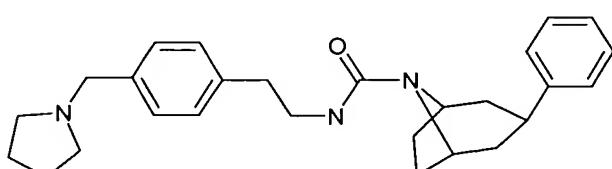
C<sub>26</sub>H<sub>32</sub>F<sub>3</sub>N<sub>3</sub>O<sub>2</sub> (M= 475.6)

20 calc.: molar peak (M+H)<sup>+</sup>: 476      fnd.: molar peak (M+H)<sup>+</sup>: 476

R<sub>f</sub> value: 0.45 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

### Example 2.21:

25



2.21.a 3-phenyl-8-aza-bicyclo[3.2.1]octane-8-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 3-phenyl-8-aza-

- 5 bicyclo[3.2.1]octane (93.7 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

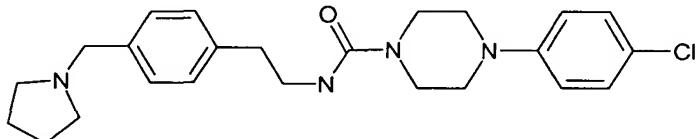
Yield: 26.0 mg (12.5 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 418      fnd.: molar peak (M+H)<sup>+</sup>: 418

- 10 R<sub>f</sub> value: 0.51 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.22:**



15

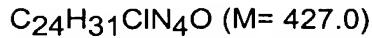
2.22.a 4-(4-chloro-phenyl)-piperazine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-(4-chloro-phenyl)-

piperazine (117 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine

- 20 (102 mg, 0.50 mmol).

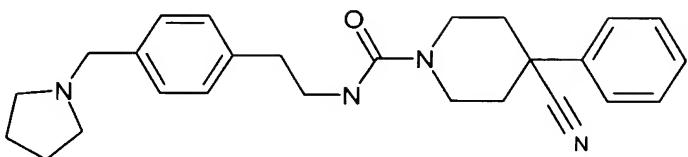
Yield: 13.0 mg (6.1 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 427/429      fnd.: molar peak (M+H)<sup>+</sup>: 427/429

- R<sub>f</sub> value: 0.42 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.23:**



5

2.23.a 4-cyano-4-phenyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-cyano-4-phenyl-piperidine (111 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 10 0.50 mmol).

Yield: 27.0 mg (13.0 % of theory)

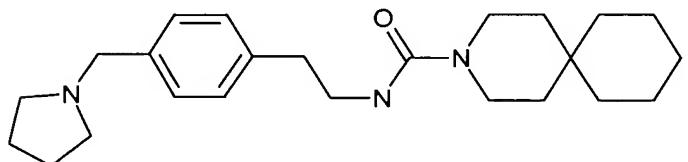
C<sub>26</sub>H<sub>32</sub>N<sub>4</sub>O (M= 416.6)

calc.: molar peak (M+H)<sup>+</sup>: 417      fnd.: molar peak (M+H)<sup>+</sup>: 417

R<sub>f</sub> value: 0.46 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

15

**Example 2.24:**



20 2.24.a 3-Aza-spiro[5.5]undecane-3-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 3-aza-spiro[5.5]undecane (76.7 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

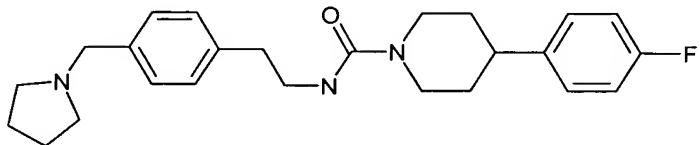
25 Yield: 24.0 mg (12.5 % of theory)

C<sub>24</sub>H<sub>37</sub>N<sub>3</sub>O (M= 383.6)

calc.: molar peak (M+H)<sup>+</sup>: 384      fnd.: molar peak (M+H)<sup>+</sup>: 384

R<sub>f</sub> value: 0.49 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

5    **Example 2.25:**



2.25.a 4-(4-fluoro-phenyl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide  
10

Prepared according to general working method II from 4-(4-fluoro-phenyl)-piperidine (108 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

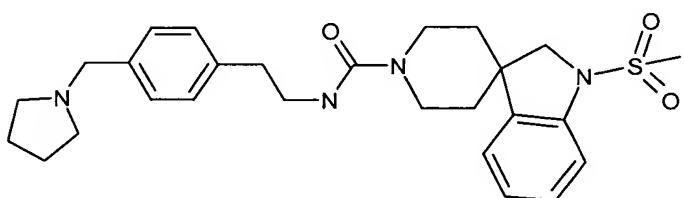
Yield: 32.0 mg (15.6 % of theory)

15    C<sub>25</sub>H<sub>32</sub>FN<sub>3</sub>O (M= 409.6)

calc.: molar peak (M+H)<sup>+</sup>: 410      fnd.: molar peak (M+H)<sup>+</sup>: 410

R<sub>f</sub> value: 0.50 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

20    **Example 2.26:**



2.26.a 1,2-dihydro-1-(methylsulphonyl)-spiro[3H-indole-3,4'-piperidine]-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 1,2-dihydro-1-(methylsulphonyl)-spiro[3H-indole-3,4'-piperidine] (133.2 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

Yield: 28.0 mg (11.3 % of theory)

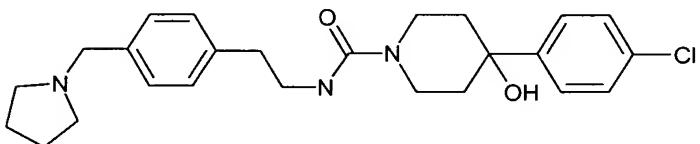
5 C<sub>27</sub>H<sub>36</sub>N<sub>4</sub>O<sub>3</sub>S (M= 496.7)

calc.: molar peak (M+H)<sup>+</sup>: 497      fnd.: molar peak (M+H)<sup>+</sup>: 497

R<sub>f</sub> value: 0.42 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

### Example 2.27:

10



2.27.a 4-(4-chloro-phenyl)-4-hydroxy-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

15 Prepared according to general working method II from 4-(4-chloro-phenyl)-4-hydroxy-piperidine (106 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

Yield: 32.0 mg (14.5 % of theory)

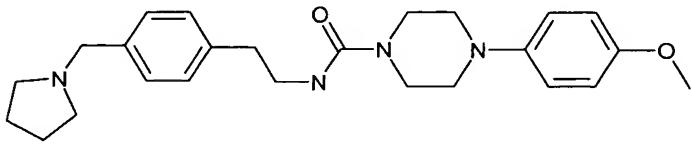
C<sub>25</sub>H<sub>32</sub>CIN<sub>3</sub>O<sub>2</sub> (M= 442.0)

20 calc.: molar peak (M+H)<sup>+</sup>: 442/444      fnd.: molar peak (M+H)<sup>+</sup>: 442/444

R<sub>f</sub> value: 0.44 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

### Example 2.28:

25



2.28.a 4-(4-methoxy-phenyl)-piperazine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-(4-methoxy-phenyl)-piperazine (133 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine

5 (102 mg, 0.50 mmol).

Yield: 35.0 mg (16.6 % of theory)

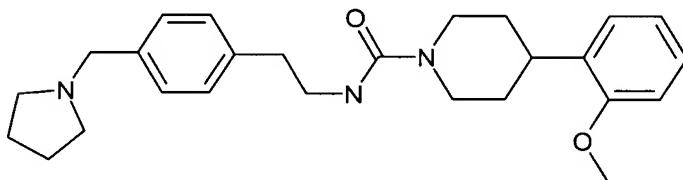
C<sub>25</sub>H<sub>34</sub>N<sub>4</sub>O<sub>2</sub> (M= 422.6)

calc.: molar peak (M+H)<sup>+</sup>: 423      fnd.: molar peak (M+H)<sup>+</sup>: 423

R<sub>f</sub> value: 0.47 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

10

**Example 2.29:**



15 2.29. 4-(2-methoxy-phenyl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-(2-methoxy-phenyl)-piperidine (114 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

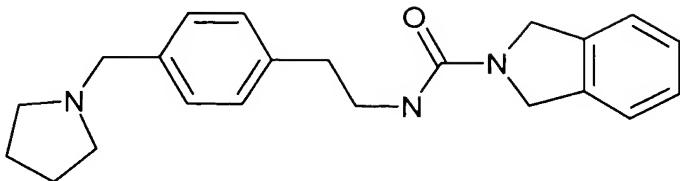
20 Yield: 20.0 mg (9.5 % of theory)

C<sub>26</sub>H<sub>35</sub>N<sub>3</sub>O<sub>2</sub> (M= 421.6)

calc.: molar peak (M+H)<sup>+</sup>: 422      fnd.: molar peak (M+H)<sup>+</sup>: 422

R<sub>f</sub> value: 0.55 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

**Example 2.30:**



5

2.30.a 1,3-dihydro-isoindole-2-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 1,3-dihydro-isoindole (77.8 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

Yield: 13.0 mg (7.4 % of theory)

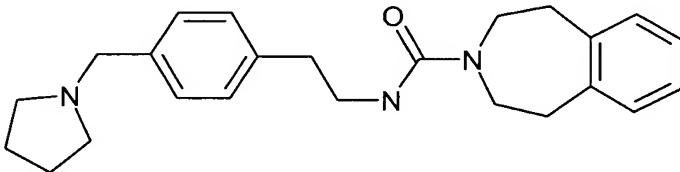
C<sub>22</sub>H<sub>27</sub>N<sub>3</sub>O (M= 349.48)

calc.: molar peak (M+H)<sup>+</sup>: 350      fnd.: molar peak (M+H)<sup>+</sup>: 350

R<sub>f</sub> value: 0.30 (silica gel, dichloromethane/methanol/NH<sub>3</sub> 9:1:0.1).

15

**Example 2.31:**



20 2.31.a 1,2,4,5-tetrahydro-benzo[d]azepine-3-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 1,2,4,5-tetrahydro-benzo[d]azepine (73.6 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

Yield: 12.0 mg (6.4 % of theory)

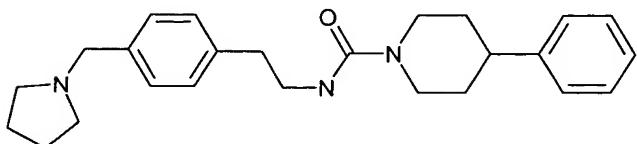
C<sub>24</sub>H<sub>31</sub>N<sub>3</sub>O (M= 377.534)

calc.: molar peak (M+H)<sup>+</sup>: 378      fnd.: molar peak (M+H)<sup>+</sup>: 378

R<sub>f</sub> value: 0.33 (silica gel, dichloromethane/methanol/NH<sub>3</sub> 9:1:0.1).

5

**Example 2.32:**



- 10 2.32.a 4-phenyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-phenyl-piperidine (80.6 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

- 15 Yield: 24.0 mg (12.3 % of theory)

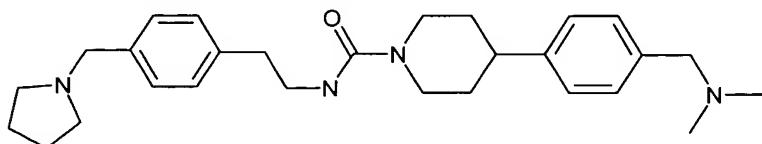
C<sub>25</sub>H<sub>33</sub>N<sub>3</sub>O (M= 391.561)

calc.: molar peak (M+H)<sup>+</sup>: 392      fnd.: molar peak (M+H)<sup>+</sup>: 392

R<sub>f</sub> value: 0.35 (silica gel, dichloromethane/methanol/NH<sub>3</sub> 9:1:0.1).

- 20 **Example 2.33:**

4-(4-dimethylaminomethyl-phenyl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



- 25 2.33.a      tert.butyl    4-(4-dimethylaminomethyl-phenyl)-4-hydroxy-piperidine-1-carboxylate

236 mL (0.38 mol, 1.6M in hexane) n-BuLi is added dropwise over 35 min at -65°C to a solution of 81 g (0.38 mol) of 4-bromodimethylbenzylamine in 450 mL THF. 75 g (0.38 mol) of tert.butyl 4-oxo-piperidine-1-carboxylate in 150 mL THF are added dropwise over 60 min, so that the temperature does not exceed -60°C. The

- 5 reaction solution is stirred for 2h at -65°C and for a further 17 h at ambient temperature. The reaction mixture is combined with 300 mL ether, cooled to 5°C and the precipitate formed is suction filtered. The precipitate is combined with 200 mL water and 700 mL ether and stirred for 10 min. The organic phase is dried over magnesium sulphate and the solvent eliminated using the rotary evaporator. The  
10 product obtained is dried in vacuo.

Yield: 45 g (35.7 % of theory)

2.33.b dimethyl-[4-(1,2,3,6-tetrahydro-pyridin-4-yl)-benzyl]-amine

- 70 mL trifluoroacetic acid is added dropwise to a solution of 45 g (0.14 mol) of  
15 tert.butyl 4-(4-dimethylaminomethyl-phenyl)-4-hydroxy-piperidine-1-carboxylate in 140 mL dichloromethane at -10°C. The solution is stirred for 1.5 h at ambient temperature, cooled to -10°C and 30 mL conc. sulphuric acid are added. After half an hour a further 10 mL sulphuric acid are added. After 1 h the solvent is  
20 eliminated using the rotary evaporator and added to 300 g of ice. The pH is adjusted to 14 with 6 N NaOH solution. The aqueous phase is saturated with potassium carbonate and extracted twice with ether. The combined organic phases are concentrated to dryness using the rotary evaporator.

Yield: 25.2 g (86.9%)

25 2.33.c dimethyl-(4-piperidin-4-yl-benzyl)-amine

- 6 g Pd/BaSO<sub>4</sub> are added to a solution of 16 g (74 mmol) of dimethyl-[4-(1,2,3,6-tetrahydro-pyridin-4-yl)-benzyl]-amine in 200 mL methanol. The solution is stirred for 1 h at ambient temperature in a hydrogen atmosphere, the catalyst is filtered off and the solvent eliminated using the rotary evaporator. The residue is dissolved  
30 in methanol, methanolic hydrochloric acid is added and then ether is added until

the mixture becomes cloudy. After storage at -20°C the hydrochloride obtained is suction filtered.

Yield: 16 g (84.9%).

- 5 2.33.d 4-(4-dimethylaminomethyl-phenyl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-(4-dimethylaminomethyl-phenyl)-piperidine (127 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

- 10 Yield: 37.0 mg (16.5 % of theory)

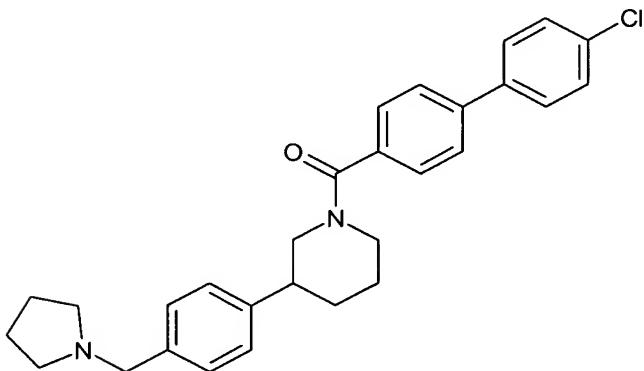


calc.: molar peak (M+H)<sup>+</sup>: 449      fnd.: molar peak (M+H)<sup>+</sup>: 449

R<sub>f</sub> value: 0.37 (silica gel, dichloromethane/methanol/NH<sub>3</sub> 9:1:0.1).

- 15 **Example 2.34:**

4'-chloro-biphenyl-4-yl)-[3-(4-pyrrolidin-1-ylmethyl-phenyl)-piperidin-1-yl]-methanone

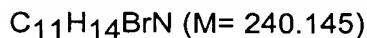


- 20 2.34.a 1-(4-Bromo-benzyl)-pyrrolidine

20.0 g (0.080 mol) of 4-bromobenzylbromide in THF is slowly added dropwise to a solution of 13.1 ml (0.16 mmol) of pyrrolidine and 200 mL tetrahydrofuran, so that the temperature does not exceed 20°C. The reaction solution is stirred overnight and after mixing with ice acidified with concentrated hydrochloric acid. After

extraction with ether the aqueous phase is made alkaline with sodium hydroxide solution and saturated with potassium carbonate. After extraction with ether the organic phase is dried over magnesium sulphate and the solvent is eliminated using the rotary evaporator.

5 Yield: 18.1 g (94.2 % of theory)



calc.: molar peak ( $M+H$ )<sup>+</sup>: 240/242      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 240/242

$R_f$  value: 0.19 (silica gel, petroleum ether/ethyl acetate 8:2).

10 2.34.b 3-(4-pyrrolidin-1-ylmethyl-phenyl)-pyridine

1.11 g (4.64 mmol) of 1-(4-bromo-benzyl)-pyrrolidine is dissolved in 10 mL dioxane and 5 mL 2M sodium carbonate solution. 570 mg (4.64 mmol) of pyridine-3-boric acid and 270 mg (0.23 mmol) of tetrakis-(triphenylphosphine)-palladium are added successively and the reaction is refluxed for 6 h. The reaction solution is suction filtered through a glass fibre filter. The filtrate is extracted several times with ethyl acetate. The organic phase is dried over magnesium sulphate and the solvent is eliminated using the rotary evaporator. Further purification is carried out by column chromatography on silica gel (eluant: ethyl acetate/methanol/ $NH_3$  = 8:2:0.1).

Yield: 500 mg (45.2 % of theory)

20  $C_{16}H_{18}N_2$  (M= 238.335)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 239      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 239

2.34.c 3-(4-pyrrolidin-1-ylmethyl-phenyl)-piperidine

4 mL 1M hydrochloric acid and 200 mg platinum oxide are added to a solution of

25 500 mg (2.10 mmol) of 3-(4-pyrrolidin-1-ylmethyl-phenyl)-pyridine in 10 mL ethanol. The reaction mixture is stirred at ambient temperature and 3 bar hydrogen for 4.5 h. After separation of the catalyst the solvent is eliminated using the rotary evaporator, while the product is precipitated as the hydrochloride.

Yield: 600 mg (100 % of theory)

30  $C_{16}H_{24}N_2^*HCl$  (M= 280.844)

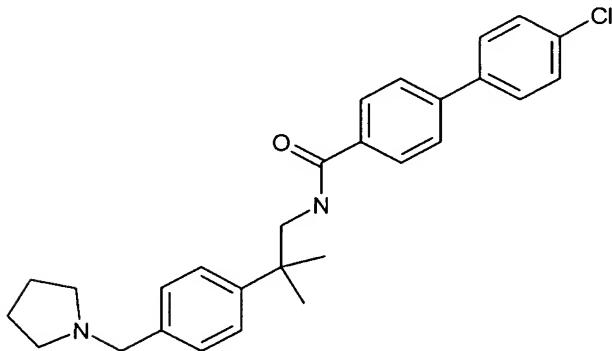
calc.: molar peak ( $M+H$ )<sup>+</sup>: 245      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 245.

2.34.d (4'-chloro-biphenyl-4-yl)-[3-(4-pyrrolidin-1-ylmethyl-phenyl)-piperidin-1-yl]-methanone

- 5 Prepared according to general working method I from 4'-chloro-biphenyl-4-carboxylic acid (183 mg, 0.78 mmol) and 3-(4-pyrrolidin-1-ylmethyl-phenyl)-piperidine (200 mg, 0.71 mmol).  
Yield: 20.0 mg (6.1 % of theory)  
 $C_{29}H_{31}ClN_2O$  ( $M= 459.036$ )
- 10 calc.: molar peak ( $M+H$ )<sup>+</sup>: 459/461      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 459/461  
 $R_f$  value: 0.58 (silica gel, ethyl acetate/methanol/ $NH_3$  9:1:0.1).

**Example 2.35:**

- 15 4'-chloro-biphenyl-4-carboxylic acid-[2-methyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-propyl]-amide



2.35.a 2-methyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-propionitrile

- 3.4 g (30 mmol) of potassium-tert-butoxide are added to a solution of 2.0 g (10.0 mmol) of (4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile (cf. 1.1.g) in 50 mL tetrahydrofuran at ambient temperature. The reaction solution is briefly stirred, combined with 1.9 mL (30 mmol) of methyl iodide, stirred for a further 2 h at ambient temperature and then evaporated to dryness using the rotary evaporator. The residue is distributed between water and ethyl acetate, the organic phase is

washed with water and dried over magnesium sulphate. The solvent is removed using the rotary evaporator and the crude product is further reacted without purification.

Yield: 1.4 g (61.3 % of theory)

5     $C_{15}H_{20}N_2$  ( $M= 228.340$ )

calc.: molar peak ( $M+H$ ) $^+$ : 229                  fnd.: molar peak ( $M+H$ ) $^+$ : 229

$R_f$  value: 0.40 (silica gel, ethyl acetate/methanol/ $NH_3$  9:1:0.1).

2.35.b 2-methyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-propylamine

10    150 mg of Raney nickel are added to a solution of 1.4 g (6.13 mmol) of 2-methyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-propionitrile in 20 mL methanolic ammonia solution. The reaction mixture is stirred overnight at 50°C under 5 bar hydrogen atmosphere. After the catalyst has been filtered off the solvent is eliminated using the rotary evaporator.

15    Yield: 1.4 g (98.3 % of theory)

$C_{15}H_{24}N_2$  ( $M= 232.372$ )

calc.: molar peak ( $M+H$ ) $^+$ : 233                  fnd.: molar peak ( $M+H$ ) $^+$ : 233

$R_f$  value: 0.30 (silica gel, ethyl acetate/methanol/ $NH_3$  9:1:0.1).

20    2.35.c. 4'-chloro-biphenyl-4-carboxylic acid-[2-methyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-propyl]-amide

Prepared according to general working method I from 4'-chloro-biphenyl-4-carboxylic acid (233 mg, 1.0 mmol) and 2-methyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-propylamine (232 mg, 1.0 mmol).

25    Yield: 400 mg (89.5 % of theory)

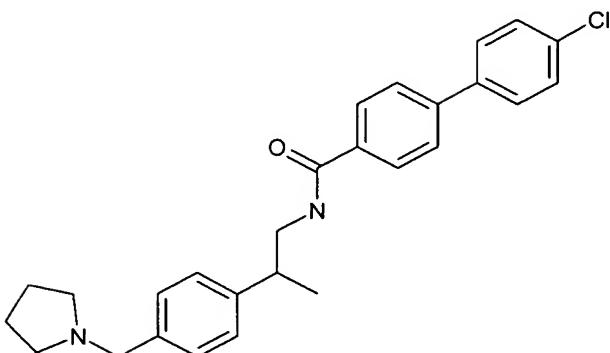
$C_{28}H_{31}ClN_2O$  ( $M= 447.025$ )

calc.: molar peak ( $M+H$ ) $^+$ : 447/449                  fnd.: molar peak ( $M+H$ ) $^+$ : 447/449

$R_f$  value: 0.35 (silica gel, ethyl acetate/methanol/ $NH_3$  9:1:0.1).

**Example 2.36:**

4'-chloro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-propyl]-amide



5

2.36.a 2-(4-pyrrolidin-1-ylmethyl-phenyl)-propionitrile

1.12 g (10 mmol) of potassium-*tert*-butoxide are added to a solution of 2.0 g (10.0 mmol) of (4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile (cf. 1.1.g) in 50 mL tetrahydrofuran at ambient temperature. The reaction solution is stirred for 30 min  
10 and then combined with 0.63 mL (10 mmol) of methyl iodide. The reaction is stirred for 1 h at 50°C and then concentrated to dryness using the rotary evaporator. The residue is distributed between water and ethyl acetate, the organic phase is washed twice with water and dried over magnesium sulphate. The solvent is removed using the rotary evaporator and the crude product, which  
15 contains approx. 20% of the dimethylated compound, is further reacted without purification.

Yield: 0.5 g (23.3 % of theory)

C<sub>14</sub>H<sub>18</sub>N<sub>2</sub> (M= 214.313)

calc.: molar peak (M+H)<sup>+</sup>: 215      fnd.: molar peak (M+H)<sup>+</sup>: 215

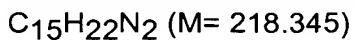
20 R<sub>f</sub> value: 0.40 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

2.36.b 2-(4-pyrrolidin-1-ylmethyl-phenyl)-propylamine

100 mg of Raney nickel are added to a solution of 400 mg (1.87 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-propionitrile in 20 mL methanolic ammonia solution.

The reaction mixture is stirred overnight at 50°C and 5 bar hydrogen atmosphere. After the catalyst has been filtered off the solvent is eliminated using the rotary evaporator. The amine, which contains approx. 20% of dimethylated compound, is further reacted without any more purification.

5 Yield: 0.4 g (98.6 % of theory)



calc.: molar peak  $(\text{M}+\text{H})^+$ : 219      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 219

$R_f$  value: 0.30 (silica gel, ethyl acetate/methanol/ $\text{NH}_3$  9:1:0.1).

10 2.36.c 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-propyl]-amide

Prepared according to general working method I from 4'-chloro-biphenyl-4-carboxylic acid (233 mg, 1.0 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-propylamine (218 mg, 1.0 mmol).

15 Yield: 10 mg (2.3 % of theory)

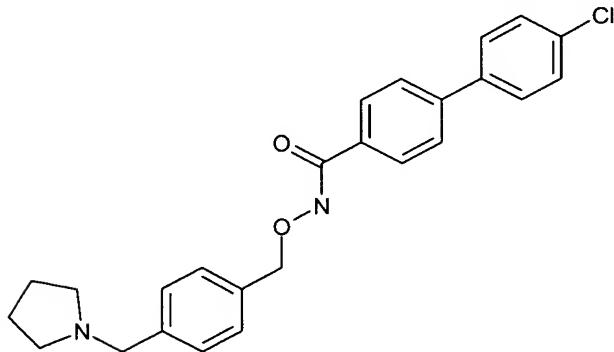


calc.: molar peak  $(\text{M}+\text{H})^+$ : 447/449      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 447/449

$R_f$  value: 0.35 (silica gel, ethyl acetate/methanol/ $\text{NH}_3$  9:1:0.1).

20 **Example 2.37:**

4'-Chloro-biphenyl-4-carboxylic acid-(4-pyrrolidin-1-ylmethyl-benzyloxy)-amide



2.37.a 2-(4-pyrrolidin-1-ylmethyl-benzyloxy)-isoindol-1,3-dione

A mixture of 8.2 g (50 mmol) of *N*-hydroxy-phthalimide and 8.7 mL (50 mmol) of Hünig base in 125 mL acetonitrile is added at ambient temperature to a solution of 13.2 g (50 mmol) of  $\alpha,\alpha'$ -dibromo-*p*-xylene in 125 mL acetonitrile. The reaction

solution is stirred for 10 min, then 4.1 mL (50 mmol) of pyrrolidine are added and

- 5 stirring is continued for one hour. After filtration the mother liquor is evaporated to dryness using the rotary evaporator. The residue is purified by chromatography on silica gel (eluant: ethyl acetate/methanol/ammonia). The substance was further reacted immediately after purification.

Yield: 1.0 g (5.9 % of theory)

- 10  $R_f$  value: 0.60 (Alox, ethyl acetate/petroleum ether 1:1).

### 2.37.b O-(4-pyrrolidin-1-ylmethyl-benzyl)-hydroxylamine

50 mL 40% methylamine solution in water are added to a solution of 1.0 g (2.97 mmol) of 2-(4-pyrrolidin-1-ylmethyl-benzyloxy)-isoindol-1,3-dione in 50 mL toluene

- 15 and the mixture is stirred for 2.5 days at ambient temperature. After separation of the organic phase the aqueous phase is extracted twice with *tert*-butylmethylether. The combined organic phases are washed with water and dried over magnesium sulphate. The solvent is eliminated using the rotary evaporator and the resulting product is further reacted without purification.

- 20 Yield: 260 mg (42.4 % of theory)

$C_{12}H_{18}N_2O$  ( $M= 206.290$ )

calc.: molar peak ( $M+H$ ) $^+$ : 207      fnd.: molar peak ( $M+H$ ) $^+$ : 207.

### 2.37.c 4'-chloro-biphenyl-4-carboxylic acid-(4-pyrrolidin-1-ylmethyl-benzyloxy)-

- 25 amide

Prepared according to general working method I from 4'-chloro-biphenyl-4-carboxylic acid (116 mg, 0.5 mmol) and O-(4-pyrrolidin-1-ylmethyl-benzyl)-hydroxylamine (103 mg, 0.5 mmol).

Yield: 10.0 mg (4.8 % of theory)

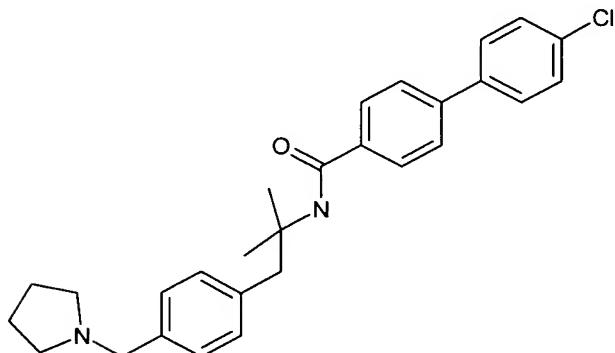
- 30  $C_{20}H_{25}ClN_2O_2$  ( $M= 420.943$ )

calc.: molar peak ( $M+H$ )<sup>+</sup>: 421/423      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 421/423

$R_f$  value: 0.38 (silica gel, ethyl acetate/methanol/ $NH_3$  9:1:0.1).

**Example 2.38:**

- 5 4'-chloro-biphenyl-4-carboxylic acid-[1,1-dimethyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.38.a ethyl (4-pyrrolidin-1-ylmethyl-phenyl)-acetate

- 10 3.0 g (15 mmol) of (4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile (cf. 1.1.g) is dissolved in ethanolic hydrochloric acid (saturated) and refluxed for 4 hours. The solvent is eliminated using the rotary evaporator and the residue is taken up with dilute  $NaHCO_3$  solution and *tert*-butylmethylether. The organic phase is dried with sodium sulphate, suction filtered through activated charcoal and then the solvent is eliminated using the rotary evaporator.

Yield: 3.4 g (91.6 % of theory)

$C_{15}H_{21}NO_2$  ( $M= 247.340$ )

calc.: molar peak ( $M+H$ )<sup>+</sup>: 248      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 248

$R_f$  value: 0.25 (silica gel, ethyl acetate/methanol/ $NH_3$  9:1:0.1).

20

2.38.b 2-methyl-1-(4-pyrrolidin-1-ylmethyl-phenyl)-propan-2-ol

3.4 g (13.8 mmol) of ethyl (4-pyrrolidin-1-ylmethyl-phenyl)-acetate in 20 mL tetrahydrofuran is added dropwise to 13.3 mL (40 mmol) of a 3.0 M methylmagnesium chloride solution in tetrahydrofuran at ambient temperature.

The temperature rises to 40°C. The reaction mixture is stirred for one hour and then poured onto 100 mL ammonium chloride solution. The aqueous phase is extracted several times with dichloromethane. The combined organic phases are washed with saturated saline solution and dried over magnesium sulphate. The

- 5 solvent is eliminated using the rotary evaporator and the residue is purified by column chromatography on Alox (activity 2-3) (eluant: cyclohexane: ethyl acetate 4:1).

Yield: 800 mg (24.9 % of theory)

C<sub>15</sub>H<sub>23</sub>NO (M= 233.357)

10 calc.: molar peak (M+H)<sup>+</sup>: 234      fnd.: molar peak (M+H)<sup>+</sup>: 234

R<sub>f</sub> value: 0.50 (Alox, petroleum ether/ethyl acetate 6:4).

2.38.c *N*-[1,1-dimethyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-formamide

A mixture of 2 mL sulphuric acid and 1 ml glacial acetic acid is added dropwise to  
15 a solution of 250 mg (5.0 mmol) of sodium cyanide in 2 mL glacial acetic acid, so  
that the temperature of the reaction mixture does not exceed 20°C. Then 800 mg  
(3.43 mmol) of 2-methyl-1-(4-pyrrolidin-1-ylmethyl-phenyl)-propan-2-ol in 2 mL  
glacial acetic acid are added dropwise. The temperature is kept below 20°C. The  
reaction solution is stirred for one hour at ambient temperature and then poured  
20 onto ice and neutralised with sodium carbonate solution. The aqueous phase is  
extracted with ether and the organic phase is dried over magnesium sulphate. The  
solvent is eliminated using the rotary evaporator and the product is further reacted  
without purification.

Yield: 520 mg (58.2 % of theory)

25 C<sub>16</sub>H<sub>24</sub>N<sub>2</sub>O (M= 260.382)

calc.: molar peak (M+H)<sup>+</sup>: 261      fnd.: molar peak (M+H)<sup>+</sup>: 261.

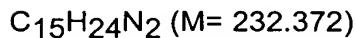
2.38.d. 1,1-dimethyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine

25 mL conc. hydrochloric acid are added to a solution of 520 mg (2 mmol) of *N*-  
30 [1,1-dimethyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-formamide in 10 mL ethanol

and the mixture is refluxed overnight. After cooling the reaction solution is made alkaline with 25% aqueous sodium hydroxide solution and the aqueous phase is extracted several times with *tert*-butylmethylether. The combined organic phases are washed with water, dried over magnesium sulphate and filtered through

- 5 activated charcoal. The solvent is eliminated using the rotary evaporator.

Yield: 380 mg (81.8 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 233      fnd.: molar peak (M+H)<sup>+</sup>: 233

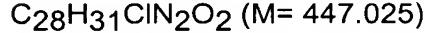
R<sub>f</sub> value: 0.10 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

10

2.38.e 4'-chloro-biphenyl-4-carboxylic acid-[1,1-dimethyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 4'-chloro-biphenyl-4-carboxylic acid (116 mg, 0.5 mmol) and 1,1-dimethyl-2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (116 mg, 0.5 mmol).

Yield: 73.0 mg (32.7 % of theory)



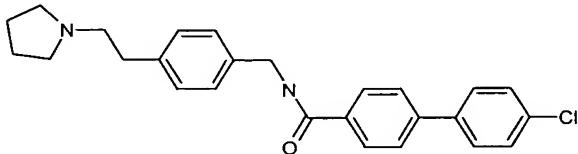
calc.: molar peak (M+H)<sup>+</sup>: 447/449      fnd.: molar peak (M+H)<sup>+</sup>: 447/449

R<sub>f</sub> value: 0.48 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

20

**Example 2.39:**

4'-chloro-biphenyl-4-carboxylic acid-4-(2-pyrrolidin-1-yl-ethyl)-benzylamide



- 25 2.39.a 4-(2-pyrrolidin-1-yl-ethyl)-benzonitrile

91 mg (0.56 mmol) of potassium iodide, 453 mg (3.28 mmol) of potassium carbonate and 0.33 mL (2.74 mmol) of 1,4-dibromobutane are added successively

to a solution of 500 mg (2.74 mmol) of 4-(2-amino-ethyl)-benzonitrile in 50 mL acetonitrile. The reaction is stirred for 6h at 78°C. Another 0.08 mL (0.66 mmol) of 1,4- dibromobutane are added and the reaction is stirred overnight at 78°C. After filtration the filtrate is evaporated to dryness. The further purification is carried out

5 by column chromatography on silica gel (dichloromethane/methanol 8:2).

Yield: 183.0 mg (33.4 % of theory)

C<sub>13</sub>H<sub>16</sub>N<sub>2</sub> (M= 200.286)

calc.: molar peak (M+H)<sup>+</sup>: 201      fnd.: molar peak (M+H)<sup>+</sup>: 201.

10 2.39.b 4-(2-pyrrolidin-1-yl-ethyl)-benzylamine

75 mg of Raney nickel is added to a solution of 183 mg (0.91 mmol) of 4-(2-pyrrolidin-1-yl-ethyl)-benzonitrile in 20 mL ethanolic ammonia solution. The reaction solution is stirred overnight at 50°C and 3 bar hydrogen. Another 75 mg of Raney nickel are added and the mixture is stirred for a further 6h at 50°C and 3

15 bar hydrogen.

The catalyst is filtered off and the solvent is eliminated using the rotary evaporator.

The crude product may be used without further purification.

Yield: 114.0 mg (61.0 % of theory)

C<sub>13</sub>H<sub>20</sub>N<sub>2</sub> (M= 204.318)

20 calc.: molar peak (M+H)<sup>+</sup>: 205      fnd.: molar peak (M+H)<sup>+</sup>: 205.

2.39.c 4'-chloro-biphenyl-4-carboxylic acid-4-(2-pyrrolidin-1-yl-ethyl)-benzylamide

Prepared according to general working method I from 4'-chloro-biphenyl-4-carboxylic acid (130 mg, 0.56 mmol) and 4-(2-pyrrolidin-1-yl-ethyl)-benzylamine

25 (114 mg, 0.56 mmol).

Yield: 75.0 mg (32.1 % of theory)

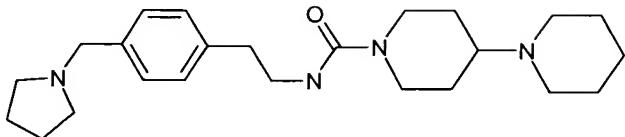
C<sub>26</sub>H<sub>27</sub>CIN<sub>2</sub>O (M= 418.971)

calc.: molar peak (M+H)<sup>+</sup>: 419/421      fnd.: molar peak (M+H)<sup>+</sup>: 419/421

R<sub>f</sub> value: 0.38 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

30

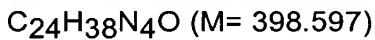
**Example 2.40:**



- 5    2.40.a [1,4']bipiperidinyl-1'-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 4-piperidinopiperidine (84.1 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol).

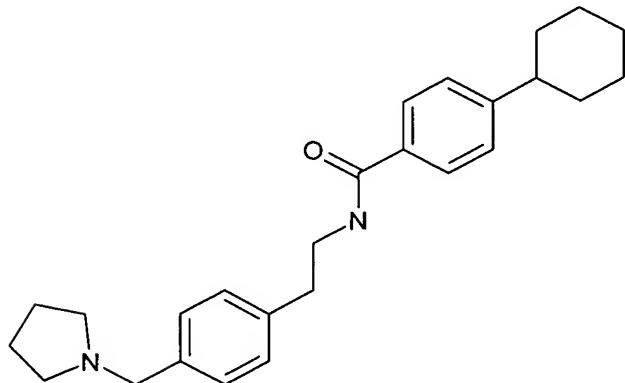
- 10   Yield: 3.0 mg (1.5 % of theory)



calc.: molar peak  $(0.5M+H)^+$ : 200      fnd.: molar peak  $(0.5M+H)^+$ : 200

Retention time HPLC: 1.59 min (method A)

- 15   **Example 2.41:**



- 2.41.a 4-cyclohexyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

Prepared according to general working method I from 4-cyclohexylbenzoic acid

- 20   (102 mg, 0.50 mmol) and 4-(2-pyrrolidin-1-yl-ethyl)-benzylamine (102 mg, 0.50 mmol).

Yield: 2.0 mg (1.0 % of theory)

C<sub>26</sub>H<sub>34</sub>N<sub>2</sub>O (M= 390.574)

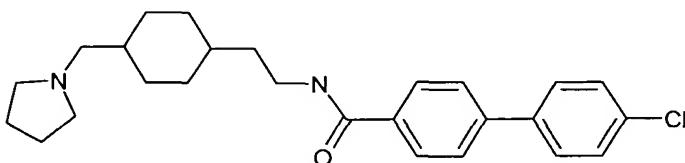
calc.: molar peak (M+H)<sup>+</sup>: 391      fnd.: molar peak (M+H)<sup>+</sup>: 391

R<sub>f</sub> value: 0.38 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

5

**Example 2.42:**

4'-chloro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-cyclohexyl)-ethyl]-amide



10

2.42.a 2-(4-pyrrolidin-1-ylmethyl-cyclohexyl)-ethylamine

1.52 mL conc. hydrochloric acid and 300 mg platinum oxide are added to a solution of 500 mg (2.45 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (cf. Example 1.1.h) in 10 mL methanol. The reaction mixture is stirred at 50°C and

15 5 bar hydrogen for 50 h. After separation of the catalyst the solvent is eliminated using the rotary evaporator. The further purification is carried out by column chromatography on silica gel (dichloromethane/ methanol/ammonia 8:2:0.2).

Yield: 130 mg (25.3 % of theory)

C<sub>13</sub>H<sub>26</sub>N<sub>2</sub> (M= 210.366)

20 calc.: molar peak (M+H)<sup>+</sup>: 211      fnd.: molar peak (M+H)<sup>+</sup>: 211

R<sub>f</sub> value: 0.14 (silica gel, dichloromethane/methanol/NH<sub>3</sub> 8:2:0.2).

2.42.b 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-cyclohexyl)-ethyl]-amide

25 Prepared according to general working method I from 4'-chloro-biphenyl-4-carboxylic acid (116 mg, 0.50 mmol) and 2-(4-pyrrolidin-1-ylmethyl-cyclohexyl)-ethylamine (105 mg, 0.50 mmol).

Yield: 53.0 mg (24.9 % of theory)

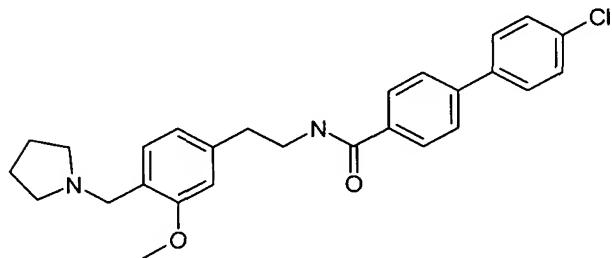
C<sub>26</sub>H<sub>33</sub>ClN<sub>2</sub>O (M= 425.019)

calc.: molar peak (M+H)<sup>+</sup>: 425/427      fnd.: molar peak (M+H)<sup>+</sup>: 425/427

R<sub>f</sub> value: 0.16 (silica gel, ethyl acetate/methanol/NH<sub>3</sub> 9:1:0.1).

5

**Example 2.43:** 4'-chloro-biphenyl-4-carboxylic acid-[2-(3-methoxy-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.43.a 4-cyanomethyl-2-methoxy-benzoic acid

10 Prepared analogously to Example 1.1.d from methyl 4-cyanomethyl-2-methoxybenzoate .

Yield: 6.5 g (69.8 % of theory)

C<sub>10</sub>H<sub>9</sub>NO<sub>3</sub> (M= 191.18)

calc.: molar peak (M+H)<sup>+</sup>: 192      fnd.: molar peak (M+H)<sup>+</sup>: 192

15 R<sub>f</sub> value: 0.64 (silica gel, dichloromethane/ethanol 10:1).

2.43.b (4-hydroxymethyl-3-methoxy-phenyl)-acetonitrile

Prepared analogously to Example 1.1.e from 4-cyanomethyl-2-methoxy-benzoic acid.

20 Yield: 4.81 g (81 % of theory)

C<sub>10</sub>H<sub>11</sub>NO<sub>2</sub> (M= 177.20)

calc.: molar peak (M)<sup>+</sup>: 177      fnd.: molar peak (M)<sup>+</sup>: 177.

2.43.c (4-bromomethyl-3-methoxy-phenyl)-acetonitrile

Prepared analogously to Example 1.1.f from (4-hydroxymethyl-3-methoxy-phenyl)-acetonitrile

Yield: 4.2 g (64.6 % of theory)

C<sub>10</sub>H<sub>10</sub>BrNO (M= 240.10)

5 calc.: molar peak (M)<sup>+</sup>: 239/241 fnd.: molar peak (M)<sup>+</sup>: 239/241

R<sub>f</sub> value: 0.84 (silica gel, dichloromethane/ethanol 50:1).

2.43.d (3-methoxy-4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile

Prepared analogously to Example 1.1.g from (4-bromomethyl-3-methoxy-phenyl)-acetonitrile and piperidine.

Yield: 0.95 g (24.2 % of theory)

C<sub>14</sub>H<sub>18</sub>N<sub>2</sub>O (M= 230.31)

calc.: molar peak (M+H)<sup>+</sup>: 231 fnd.: molar peak (M+H)<sup>+</sup>: 231.

15 2.43.e (3-methoxy-4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine

Prepared analogously to Example 1.1.h from (3-methoxy-4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile. The crude product is further reacted immediately without purification.

20 2.43.f 4'-chloro-biphenyl-4-carboxylic acid-[2-(3-methoxy-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 2-(3-methoxy-4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 0.5 g (86.2 % of theory)

25 melting point: 162-163°C

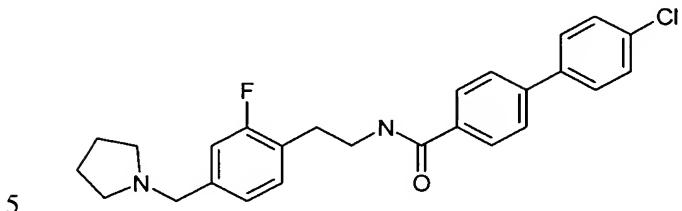
C<sub>27</sub>H<sub>29</sub>CIN<sub>2</sub>O<sub>2</sub> (M= 448.99)

calc.: molar peak (M+H)<sup>+</sup>: 449/451 fnd.: molar peak (M+H)<sup>+</sup>: 449/451

R<sub>f</sub> value: 0.85 (silica gel, dichloromethane/ethanol/ammonia 5:1:0.1).

**Example 2.44:**

4'-chloro-biphenyl-4-carboxylic acid-[2-(2-fluoro-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.44.a (*E*)-3-(4-cyano-2-fluoro-phenyl)-acrylic acid 2.75 g (10 mmol) of palladium acetate and 7.0g (25 mmol) of tri-*o*-tolylphosphane are added to a solution of 20.0 g (100 mmol) of 4-bromo-3-fluoro-benzonitrile in 200 mL DMF. Then 50 mL

- 10 triethylamine and 30 mL (30 mmol) of ethyl acrylate are added. The reaction mixture is stirred for 3 h at 100°C, after cooling diluted with 400 mL dichloromethane and washed twice with water. The solvent is eliminated using the rotary evaporator and the residue is taken up in 250 mL methanol with heating. Insoluble constituents are removed by suction filtering through kieselguhr and the 15 filtrate is evaporated down by half in the rotary evaporator. After filtering again, it is combined with 150 mL THF, 100 mL MeOH and 43 mL 2N NaOH and stirred for 2 h at ambient temperature. The solvent is eliminated using the rotary evaporator and the residue is combined with 100 mL water. After extraction with ether the aqueous phase is acidified with conc. hydrochloric acid. The crystals precipitated 20 are dissolved in 300 ml of warm ethyl acetate, the aqueous phase is separated off. The ethyl acetate is distilled off and the crystals obtained are suspended in ether and suction filtered.

Yield: 11.5 g (60.2 % of theory)

melting point: 214-218°C.

25

2.44.b 3-(4-cyano-2-fluoro-phenyl)-propionic acid

A solution of 11.5 g (60 mmol) of (*E*)-3-(4-cyano-2-fluoro-phenyl)-acrylic acid in 200 mL water is combined with 4.0 g 5% Pd/C and 24.4 g potassium carbonate.

The mixture is shaken for 6 h at ambient temperature and normal hydrogen pressure in the autoclave. After suction filtering of the catalyst the mother liquor is

- 5 acidified with conc. hydrochloric acid. The precipitated crystals are dissolved in 250 ml warm ethyl acetate and dried and the ethyl acetate is distilled off. The crystals obtained are stirred with ether/hexane and suction filtered.

Yield: 900 mg (98.0 % of theory)

melting point: 102-106°C.

10

2.44.c tert.butyl [2-(4-cyano-2-fluoro-phenyl)-ethyl]-carbaminate

1.25 mL triethylamine and 0.61 mL (2.8 mmol) of diphenylphosphorylazide are added to a solution of 500 mg (2.6 mmol) of 3-(4-cyano-2-fluoro-phenyl)-propionic acid in 5 mL *tert*-butanol. The reaction mixture is refluxed overnight and then the

- 15 solvent is eliminated using the rotary evaporator. The purification is carried out by column chromatography on silica gel (dichloromethane/methanol 9:1).

Yield: 138 mg (20.2 % of theory)

C<sub>14</sub>H<sub>17</sub>FN<sub>2</sub>O<sub>2</sub> (M= 264.302)

calc.: molar peak (M+H)<sup>+</sup>: 265      fnd.: molar peak (M+H)<sup>+</sup>: 265

20

2.44.d tert.butyl [2-(4-aminomethyl-2-fluoro-phenyl)-ethyl]-carbaminate

A solution of 138 mg (0.52 mmol) of tert.butyl [2-(4-cyano-2-fluoro-phenyl)-ethyl]-

carbaminate in 15 mL ethanolic ammonia solution is combined with 75 mg of Raney nickel and the mixture is shaken overnight at 50°C and 3 bar hydrogen in

- 25 the autoclave. After the catalyst has been suction filtered the solvent is eliminated using the rotary evaporator.

Yield: 137 mg (97.8 % of theory)

C<sub>14</sub>H<sub>21</sub>FN<sub>2</sub>O<sub>2</sub> (M= 268.334)

calc.: molar peak (M+H)<sup>+</sup>: 269      fnd.: molar peak (M+H)<sup>+</sup>: 269.

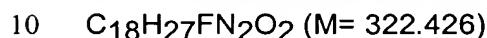
30

2.44.e tert.butyl [2-(2-fluoro-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-carbaminate

To a solution of 300 mg (1.12 mmol) of tert.butyl [2-(4-aminomethyl-2-fluoro-phenyl)-ethyl]-carbaminate in 15 mL acetonitrile are added successively 42 mg (0.25 mmol) of potassium iodide, 180 mg (1.30 mmol) of potassium carbonate and

- 5 0.13 mL (1.11 mmol) of 1,4-dibromobutane. The reaction is stirred for 6h at 78°C. Another 0.08 mL (0.66 mmol) of 1,4-dibromobutane are added and the reaction is stirred overnight at 78°C. The solvent is eliminated using the rotary evaporator and the product further reacted without purification.

Yield: 320 mg (88.8 % of theory)



calc.: molar peak ( $M+H$ )<sup>+</sup>: 323      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 323.

2.44.f 2-(2-fluoro-4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine

To a solution of 232 mg (0.72 mmol) of tert.butyl [2-(2-fluoro-4-pyrrolidin-1-

- 15 ylmethyl-phenyl)-ethyl]-carbaminate in 5 mL dichloromethane is added 1.5 mL trifluoroacetic acid. The reaction mixture is stirred for 2 h at ambient temperature. The solvent is eliminated using the rotary evaporator and the crude product is further reacted without purification.

Yield: 160 mg (100 % of theory)



calc.: molar peak ( $M+H$ )<sup>+</sup>: 223      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 223.

2.44.g 4'-chloro-biphenyl-4-carboxylic acid-[2-(2-fluoro-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

- 25 Prepared according to general working method I from 2-(2-fluoro-4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (160 mg, 0.72 mmol) and 4'-chloro-biphenyl-4-carboxylic acid (168 mg, 0.72 mmol).

Yield: 49 mg (15.6 % of theory)



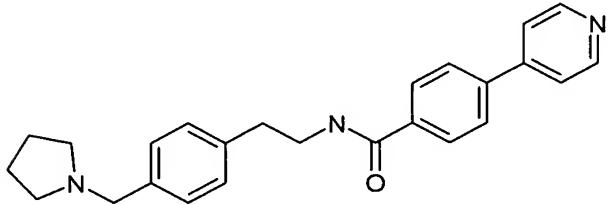
- 30 calc.: molar peak ( $M+H$ )<sup>+</sup>: 437/439      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 437/439

Retention time HPLC: 6.6 min (method A)

**Example 2.45:**

4-pyridin-4-yl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

5



2.45a. methyl 4-pyridin-4-yl-benzoate

3.0 g (15 mmol) of 4-bromo-pyridine is dissolved in 50 mL dioxane and 15 mL 2M sodium carbonate solution. 2.7 g (15 mmol) of 4-methoxycarbonylphenyl-boric acid and 1.73 g (2 mmol) of tetrakis-(triphenylphosphine)-palladium are added successively and the reaction is refluxed for 6 h. The hot reaction solution is suction filtered through a glass fibre filter. The solvent is eliminated using the rotary evaporator and the purification is carried out by column chromatography on silica gel (dichloromethane/methanol 9:1).

15 Yield: 845 mg (26.4 % of theory)

C<sub>13</sub>H<sub>11</sub>NO<sub>2</sub> (M= 213.238)

calc.: molar peak (M+H)<sup>+</sup>: 214      fnd.: molar peak (M+H)<sup>+</sup>: 214

Retention time HPLC: 4.1 min (method A)

20 2.45b. 4-pyridin-4-yl-benzoic acid

0.37 mL (0.74 mmol) of 2N NaOH are added to a solution of 150 mg (0.70 mmol) of methyl 4-pyridin-4-yl-benzoate in 10 mL ethanol. The reaction solution is stirred for 2 h at 60°C and then the pH is adjusted to 6-7 with 1N HCl. After filtration the precipitate formed is dried overnight under high vacuum.

25 Yield: 84 mg (60.0 % of theory)

C<sub>12</sub>H<sub>9</sub>NO<sub>2</sub> (M= 199.211)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 200      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 200

Retention time HPLC: 2.5 min (method A)

2.45c. 4-pyridin-4-yl-*N*-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

- 5 Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (86 mg, 0.42 mmol) and 4-pyridin-4-yl-benzoic acid (84 mg, 0.42 mmol).

Yield: 65 mg (40.0 % of theory)

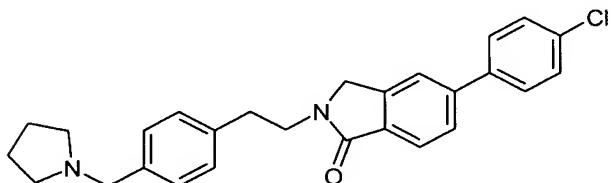
C<sub>25</sub>H<sub>27</sub>N<sub>3</sub>O (M= 385.513)

- 10 calc.: molar peak ( $M+H$ )<sup>+</sup>: 386      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 386

Retention time HPLC: 4.7 min (Stable Bond C18; 3.5 μm; water:acetonitrile:formic acid 91:9:0.01).

**Example 2.46:**

- 15 5-(4-chloro-phenyl)-2-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-2,3-dihydro-isoindol-1-one



2.46.a ethyl 4-bromo-2-methyl- benzoate

- 20 A solution of 5.0 g (23.3 mmol) of 4-bromo-2-methyl-benzoic acid in 50 mL ethanolic hydrochloric acid is stirred for 8 h at 45°C. The reaction solution is cooled to ambient temperature overnight and then the solvent is eliminated using the rotary evaporator. The residue is taken up in ether, filtered and the solvent is eliminated using the rotary evaporator. The residue is further reacted without  
25 purification.

R<sub>f</sub> value: 0.88 (silica gel, dichloromethane/ethanol 95:5).

2.46.b ethyl 4'-chloro-3-methyl-biphenyl-4-carboxylate

1.66 g (6.83 mmol) of ethyl 4-bromo-2-methyl- benzoate is dissolved in 70 mL dioxane and 7 mL 2M sodium carbonate solution. 1.07 g (6.83 mmol) of 4-chlorophenyl-boric acid and 0.40 g (0.34 mmol) of tetrakis-(triphenylphosphine)-

5 palladium are added successively, the reaction is refluxed for 6 h and stirred for a further 60 h at ambient temperature. The hot reaction solution is suction filtered through a glass fibre filter. The solvent is eliminated using the rotary evaporator. The residue is combined with water and the aqueous phase extracted with ethyl acetate. The organic phase is dried over magnesium sulphate and the solvent is  
10 eliminated using the rotary evaporator. The purification is carried out by column chromatography on silica gel (petroleum ether/ethyl acetate 8:2).

Yield: 1.3 g (69.3 % of theory)

C<sub>16</sub>H<sub>15</sub>ClO<sub>2</sub> (M= 274.750)

calc.: molar peak (M+H)<sup>+</sup>: 275/277 fnd.: molar peak (M+H)<sup>+</sup>: 275/277

15 R<sub>f</sub> value: 0.67 (silica gel, petroleum ether/ethyl acetate 8:2).

2.46.c ethyl 3-bromomethyl-4'-chloro-biphenyl-4-carboxylate

78 mg (0.47 mmol) of 2,2'-azobis(isobutyronitrile) are added to a solution of 1.3 g (4.73 mmol) of ethyl 4'-chloro-3-methyl-biphenyl-4-carboxylate and 0.84 g (4.73

20 mmol) of N-bromosuccinimide in 10 mL carbon tetrachloride. The reaction mixture is refluxed overnight. After filtration the solvent is evaporated down in the rotary evaporator. The purification is carried out by column chromatography on silica gel (petroleum ether/ethyl acetate 8:2).

Yield: 1.6 g (62.1 % of theory)

25 C<sub>16</sub>H<sub>14</sub>BrClO<sub>2</sub> (M= 353.646)

calc.: molar peak (M+H)<sup>+</sup>: 353/355/357 fnd.: molar peak (M+H)<sup>+</sup>:  
353/355/357

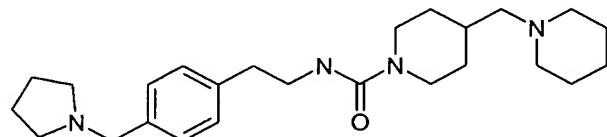
R<sub>f</sub> value: 0.57 (silica gel, petroleum ether/ethyl acetate 8:2).

2.46.d 5-(4-chloro-phenyl)-2-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-2,3-dihydro-isoindol-1-one

- 375 mg (1.47 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine is slowly added dropwise at ambient temperature to a suspension of 800 mg (1.47 mmol) of ethyl 3-bromomethyl-4'-chloro-biphenyl-4-carboxylate and 508 mg (3.68 mmol) of potassium carbonate in 7.5 mL acetonitrile. The reaction mixture is refluxed for 5 hours. After elimination of the solvent using the rotary evaporator the residue is taken up in water and ethyl acetate. The aqueous phase is extracted with ethyl acetate and the combined organic phases are dried over magnesium sulphate.
- 10 After elimination of the solvent using the rotary evaporator the residue is dissolved in DMF and purified by HPLC chromatography (Stable Bond C18; 3.5 µm; water:acetonitrile:formic acid 9:1:0.01 towards 1:9:0.01 over 9 min).  
Yield: 82 mg (12.9 % of theory)  
 $C_{27}H_{27}ClN_2O_2$  ( $M= 430.982$ )
- 15 calc.: molar peak  $(M+H)^+$ : 431/433      fnd.: molar peak  $(M+H)^+$ : 431/433  
Retention time HPLC: 6.13 min (method A)

**Example 2.47:**

- 4-piperidin-1-ylmethyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.47.a 4-piperidin-1-ylmethyl-pyridine

- 242 mL piperidine (2.44 mol) are added dropwise to a solution of 100 g (0.61 mol) of 4-chloromethyl-pyridine in 600 mL dry methanol and the reaction mixture is stirred for one hour at 50°C. The solvent is eliminated using the rotary evaporator. The residue is made alkaline with 40% sodium hydroxide solution and the aqueous phase extracted with ether. The organic phase is dried over sodium

sulphate and after filtration through activated charcoal the solvent is eliminated using the rotary evaporator. The crude product is further reacted without purification.

Yield: 106 g (98 % of theory)

5

**2.47.b 4-piperidin-1-ylmethyl-piperidine**

A solution of 106 g (0.6 mol) of 4-piperidin-1-ylmethyl-pyridine in 1.0 L glacial acetic acid is combined with 7 g platinum dioxide and shaken in the autoclave at ambient temperature and 3 bar hydrogen. After the catalyst has been suction

10 filtered the solvent is eliminated using the rotary evaporator. The crude product is further reacted without purification.

Yield: 48 g (43.9 % of theory)

**2.47.c 4-piperidin-1-ylmethyl-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide**

Prepared according to general working method II from 4-piperidin-1-ylmethyl-piperidine (182 mg, 1.00 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (204 mg, 1.00 mmol).

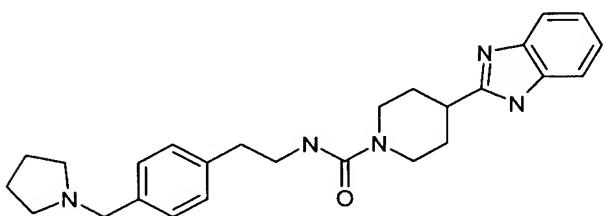
Yield: 160.0 mg (38.8 % of theory)

20 C<sub>25</sub>H<sub>40</sub>N<sub>4</sub>O (M= 412.624)

calc.: molar peak (M+H)<sup>+</sup>: 413      fnd.: molar peak (M+H)<sup>+</sup>: 413

Retention time HPLC: 1.75 min (Stable Bond C18; 3.5 µm;  
water:acetonitrile:formic acid 9:1:0.01 towards 4:6:0.01 over 8 min).

25 **Example 2.48:**

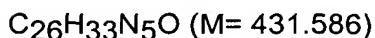


2.48.a 4-(1*H*-benzoimidazol-2-yl)-piperidine-1-carboxylic acid-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method II from 2-piperidin-4-yl-1*H*-benzoimidazole (164 mg, 1.00 mmol) and 2-(4-pyrrolidin-1-ylmethyl-phenyl)-

5 ethylamine (204 mg, 1.00 mmol).

Yield: 80.0 mg (18.5 % of theory)



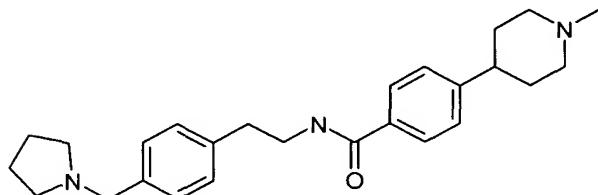
calc.: molar peak (M+H)<sup>+</sup>: 432      fnd.: molar peak (M+H)<sup>+</sup>: 432

Retention time HPLC: 2.80 min (Stable Bond C18; 3.5 µm;

10 water:acetonitrile:formic acid 9:1:0.01 towards 4:6:0.01 over 8 min).

**Example 2.49:**

4-(1-methyl-piperidin-4-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



15

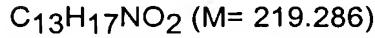
2.49.a methyl 4-piperidin-4-yl-benzoate

4.0 mL 1M hydrochloric acid and 200 mg platinum oxide are added to a solution of 695 mg (3.26 mmol) of methyl 4-pyridin-4-yl-benzoate (cf. Example 2.45.a) in 10

20 mL ethanol. The reaction mixture is stirred for 2 h at ambient temperature and 3 bar hydrogen. After another 300 mg platinum oxide and 6.0 mL 1M hydrochloric acid have been added the mixture is stirred for a further 16 h at ambient temperature and 3 bar hydrogen. After separation of the catalyst the solvent is eliminated using the rotary evaporator. The crude product is further reacted

25 without purification.

Yield: 589 mg (82.4 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 220      fnd.: molar peak (M+H)<sup>+</sup>: 220

Retention time HPLC: 3.5 min (method A)

2.49.b methyl 4-(1-methyl-piperidin-4-yl)-benzoate

- 5    48 mg (2.00 mmol) of sodium hydride is added batchwise to a solution of 429 mg (1.96 mmol) of methyl 4-piperidin-4-yl-benzoate in 10 mL DMF under a nitrogen atmosphere at 0°C. The reaction mixture is stirred for 1 h at ambient temperature. 0.13 mL (2.10 mmol) of methyl iodide is added dropwise and the solution is stirred for two hours at ambient temperature. The reaction solution is combined with  
10    water, the aqueous phase is extracted with ethyl acetate, the combined organic phases are dried over magnesium sulphate and the solvent is eliminated using the rotary evaporator. The purification is carried out by column chromatography (silica gel; dichloromethane/methanol 8:2).

Yield: 70 mg (15.3 % of theory)

15    C<sub>14</sub>H<sub>19</sub>NO<sub>2</sub> (M= 233.313)

calc.: molar peak (M+H)<sup>+</sup>: 234      fnd.: molar peak (M+H)<sup>+</sup>: 234

Retention time HPLC: 2.7 min (method A)

2.49.c 4-(1-methyl-piperidin-4-yl)-benzoic acid

- 20    0.37 mL (0.74 mmol) of 2N NaOH are added to a solution of 70 mg (0.30 mmol) of methyl 4-(1-methyl-piperidin-4-yl)-benzoate in 10 mL ethanol. The reaction solution is stirred for 2 h at 60°C and then adjusted to pH 6-7 using 1N HCl. After filtration the precipitate formed is dried overnight under high vacuum.

Yield: 50 mg (76.0 % of theory)

25    C<sub>13</sub>H<sub>17</sub>NO<sub>2</sub> (M= 219.286)

calc.: molar peak (M+H)<sup>+</sup>: 220      fnd.: molar peak (M+H)<sup>+</sup>: 220

Retention time HPLC: 1.5 min (method A)

2.49.d 4-(1-methyl-piperidin-4-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-

- 30    benzamide

Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (47 mg, 0.23 mmol) and 4-(1-methyl-piperidin-4-yl)-benzoic acid (50 mg, 0.23 mmol).

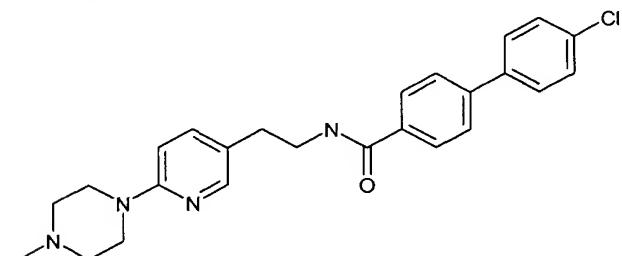
Yield: 22 mg (23.8 % of theory)

5 C<sub>26</sub>H<sub>35</sub>N<sub>3</sub>O (M= 405.588)

calc.: molar peak (M+H)<sup>+</sup>: 406      fnd.: molar peak (M+H)<sup>+</sup>: 406

Retention time HPLC: 2.4 min (method A)

**Example 2.50:**



10

1.21.a 4'-chloro-biphenyl-4-carboxylic acid-{2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethyl}-amide

Prepared analogously to Example 1.1.i from 2-[6-(4-methyl-piperazin-1-yl)-pyridin-3-yl]-ethylamine and 4'-chloro-biphenyl-4-carboxylic acid.

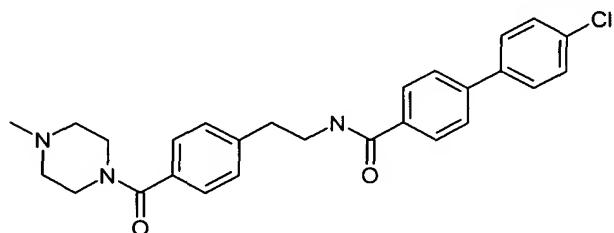
15 Yield: 0.94 g (96 % of theory)

melting point: 211-213°C

C<sub>25</sub>H<sub>27</sub>CIN<sub>4</sub>O (M= 434.97)

calc.: molar peak (M+H)<sup>+</sup>: 435/437      fnd.: molar peak (M+H)<sup>+</sup>: 435/437.

**Example 2.51:** 4'-chloro-biphenyl-4-carboxylic acid-{2-[4-(4-methyl-piperazine-1-carbonyl)-phenyl]-ethyl}-amide



5 2.51.a [4-(4-methyl-piperazine-1-carbonyl)-phenyl]-acetonitrile

A solution of 2 g (12.41 mmol) of 4-cyanomethyl-benzoic acid, 1.25 g (12.5 mmol) of N-methylpiperazine, 4.01 g (12.5 mmol) of TBTU and 3.48 ml (25 mmol) of triethylamine in 40 ml DMF is stirred for 12 hours at ambient temperature. Then the reaction mixture is evaporated down to some extent and combined with water.

10 This mixture is extracted with ethyl acetate and the solvent is distilled off using the rotary evaporator. The aqueous phase is also evaporated down and the organic phase is combined with the residue. The purification is carried out by column chromatography on silica gel (eluant: dichloromethane/ ethanol/ammonia 30:1:0.1).

15 Yield: 2.6 g (86 % of theory)

C<sub>14</sub>H<sub>17</sub>N<sub>3</sub>O (M= 243.31)

calc.: molar peak (M+H)<sup>+</sup>: 244      fnd.: molar peak (M+H)<sup>+</sup>: 244

R<sub>f</sub> value: 0.35 (silica gel, dichloromethane/ethanol/ammonia 20:1:0.1).

20 2.51.b [4-(2-amino-ethyl)-phenyl]-{4-(4-methyl-piperazin-1-yl)-methanone}

Prepared analogously to Example 1.1.i from [4-(4-methyl-piperazine-1-carbonyl)-phenyl]-acetonitrile.

Yield: 2.9 g (90 % of theory)

C<sub>14</sub>H<sub>21</sub>N<sub>3</sub>O x HCl (M= 283.80)

25 R<sub>f</sub> value: 0.25 (silica gel, dichloromethane/ethanol/ammonia 10:1:0.1).

2.51.c 4'-chloro-biphenyl-4-carboxylic acid-{2-[4-(4-methyl-piperazine-1-carbonyl)-phenyl]-ethyl}-amide

Prepared according to general working method I from [4-(2-amino-ethyl)-phenyl]- (4-methyl-piperazin-1-yl)-methanone and 4'-chloro-biphenyl-4-carboxylic acid.

5 Yield: 0.18 g (48.4 % of theory)

melting point: 217-218°C

C<sub>27</sub>H<sub>28</sub>ClN<sub>3</sub>O<sub>2</sub> (M= 461.99)

calc.: molar peak (M+H)<sup>+</sup>: 462/464      fnd.: molar peak (M+H)<sup>+</sup>: 462/464

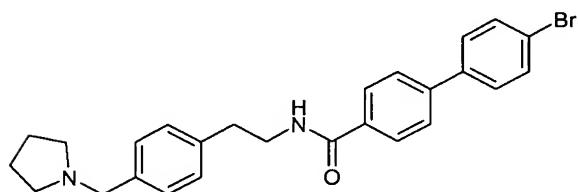
R<sub>f</sub> value: 0.25 (silica gel, dichloromethane/methanol/ammonia 10:1:0.1).

10

**Example 2.52:**

4'-bromo-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]- amide

15



2.52a. methyl 4'-bromo-biphenyl-4-carboxylate

0.54 g (2.5 mmol) of methyl 4-bromo-benzoate is dissolved in 10 mL dioxane and 2.5 mL 2M-sodium carbonate solution. 0.6 g (3 mmol) of 4-bromophenyl-boric acid and 0.12 g (0.1 mmol) of tetrakis-(triphenylphosphine)-palladium are added successively and the reaction is refluxed for 5 hours. The reaction mixture is combined with water and EtOAc, filtered and the phases are separated. The aqueous phase is extracted with EtOAc and the combined organic phases are dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is triturated with acetonitrile, suction filtered and dried in the air.

25 Yield: 100 mg (13.7 % of theory)

C<sub>14</sub>H<sub>11</sub>BrO<sub>2</sub> (M= 291.15)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 291/293      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 291/293

$R_f$  value: 0.68 (silica gel, petroleum ether/EtOAc 8:2).

2.52b. 4'-bromo-biphenyl-4-carboxylic acid

- 5 A solution of 100 mg (0.34 mmol) of methyl 4'-bromo-biphenyl-4-carboxylate in 3 mL THF is combined with 3 mL of a 1M NaOH solution in water and refluxed for 3 h. The reaction mixture is evaporated down in vacuo, the aqueous residue acidified with 1 M HCl, the product precipitated is filtered off and dried in the air.  
Yield: 60 mg (63.1 % of theory)

10  $C_{13}H_9BrO_2$  ( $M= 277.19$ )

calc.: molar peak ( $M-H$ )<sup>-</sup>: 275/277      fnd.: molar peak ( $M-H$ )<sup>-</sup>: 275/277

Retention time HPLC: 8.48 min (method A)

2.52.c 4'-bromo-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

15 Prepared according to general working method I from 45 mg (0.22 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 60 mg (0.22 mmol) of 4'-bromo-biphenyl-4-carboxylic acid.

Yield: 28 mg (27.5 % of theory)

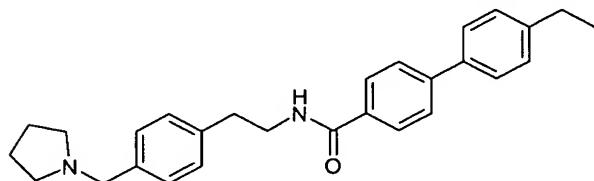
20  $C_{26}H_{27}BrN_2O$  ( $M= 463.42$ )

calc.: molar peak ( $M+H$ )<sup>+</sup>: 463/465      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 463/465

Retention time HPLC: 6.46 min (method A)

**Example 2.53:**

25 4'-ethyl-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 113 mg (0.5 mmol) of 4'-ethyl-biphenyl-4-carboxylic acid (Lancaster).

Yield: 65 mg (31.5 % of theory)

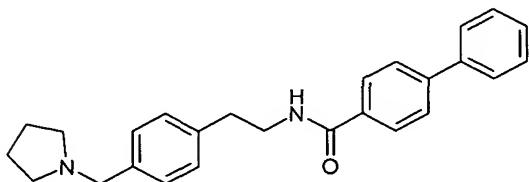
5 C<sub>28</sub>H<sub>32</sub>N<sub>2</sub>O (M= 412.58)

calc.: molar peak (M+H)<sup>+</sup>: 463      fnd.: molar peak (M+H)<sup>+</sup>: 463

Retention time HPLC: 6.64 min (method A)

**Example 2.54:**

10 biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 99 mg (0.5 mmol) of biphenyl-4-carboxylic acid.

15 Yield: 46 mg (23.9 % of theory)

C<sub>26</sub>H<sub>28</sub>N<sub>2</sub>O (M= 384.53)

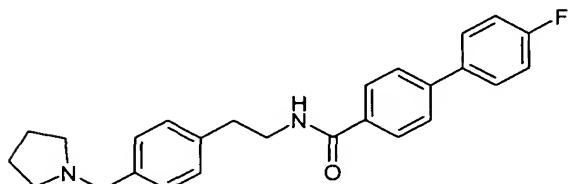
calc.: molar peak (M+H)<sup>+</sup>: 385      fnd.: molar peak (M+H)<sup>+</sup>: 385

Retention time HPLC: 5.70 min (method A)

20

**Example 2.55:**

4'-fluoro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.55a. 4'-fluoro-biphenyl-4-carboxylic acid

14.27 g (71 mmol) of 4-bromo-benzoic acid are dissolved in 120 mL dioxane and 70 mL 2M  $\text{Na}_2\text{CO}_3$  solution. 10 g (71 mmol) of 4-fluorophenyl-boric acid and 4.1 g (4 mmol) of tetrakis-(triphenylphosphine)-palladium are added successively and

5 the reaction is refluxed for 6 h. The catalyst is suction filtered and washed with hot water. The reaction mixture is combined with EtOAc, the phases are separated and the aqueous phase is acidified with citric acid. The precipitate formed is suction filtered, washed with water and dried at 45°C in vacuo.

Yield: 4.9 g (31.9 % of theory)

10  $\text{C}_{13}\text{H}_9\text{FO}_2$  ( $M= 216.21$ )

calc.: molar peak ( $M-\text{H}^-$ ): 215      fnd.: molar peak ( $M-\text{H}^-$ ): 215

2.55b. 4'-fluoro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

15 Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 108 mg (0.5 mmol) of 4'-fluoro-biphenyl-4-carboxylic acid.

Yield: 12 mg (6.0 % of theory)

$\text{C}_{26}\text{H}_{27}\text{FN}_2\text{O}$  ( $M= 402.52$ )

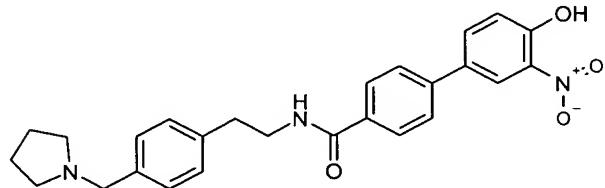
20 calc.: molar peak ( $M+\text{H}^+$ ): 403      fnd.: molar peak ( $M+\text{H}^+$ ): 403

Retention time HPLC: 5.83 min (method A)

**Example 2.56:**

4'-hydroxy-3'-nitro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-

25 ethyl]-amide



Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 130 mg (0.5 mmol) of 4'-fluoro-3'-nitro biphenyl-4-carboxylic acid.

Yield: 9 mg (4.0 % of theory)

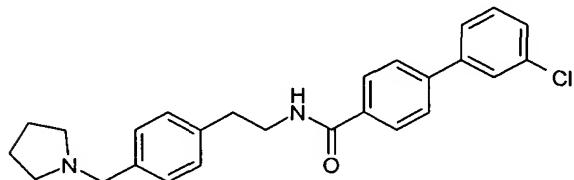
5 C<sub>26</sub>H<sub>27</sub>N<sub>3</sub>O<sub>4</sub> (M= 445.52)

calc.: molar peak (M+H)<sup>+</sup>: 446      fnd.: molar peak (M+H)<sup>+</sup>: 446

Retention time HPLC: 5.83 min (method A)

**Example 2.57:**

10 3'-chloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



**2.57a. 3'-chloro-biphenyl-4-carboxylic acid**

15 Prepared analogously to Example 2.55a from 9.64 g (47.96 mmol) of 4-bromo-benzoic acid and 7.5 g (47.96 mmol) of 3-chlorophenyl-boric acid.

Yield: 6.2 g (55.6 % of theory)

C<sub>13</sub>H<sub>9</sub>ClO<sub>2</sub> (M= 232.67)

calc.: molar peak (M-H)<sup>-</sup>: 231/233      fnd.: molar peak (M-H)<sup>-</sup>: 231/233

20

**2.57b. 3'-chloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide**

Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 116 mg (0.5 mmol) of 3'-chloro-

25 biphenyl-4-carboxylic acid.

Yield: 63 mg (30.1 % of theory)

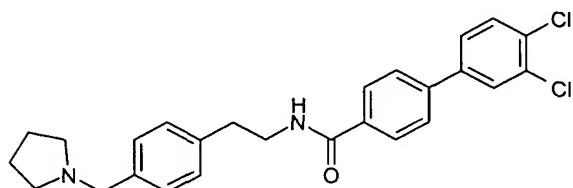
C<sub>26</sub>H<sub>27</sub>ClN<sub>2</sub>O (M= 418.97)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 419/421      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 419/421

Retention time HPLC: 6.20 min (method A)

**Example 2.58:**

- 5    3'.4'-dichloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.58a. 3'.4'-dichloro-biphenyl-4-carboxylic acid

- 10    Prepared analogously to Example 2.55a from 5.27 g (26.20 mmol) of 4-bromo-benzoic acid and 5.0 g (26.20 mmol) of 3'.4'-dichloro-phenylboric acid.

Yield: 4.05 g (57.9 % of theory)

$C_{13}H_8Cl_2O_2$  ( $M= 267.11$ )

calc.: molar peak ( $M-H$ )<sup>-</sup>: 265/267/269      fnd.: molar peak ( $M-H$ )<sup>-</sup>: 265/267/269

15

2.58b. 3'.4'-dichloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

- Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 134 mg (0.5 mmol) of 3'.4'-dichloro-biphenyl-4-carboxylic acid.

Yield: 45 mg (19.8 % of theory)

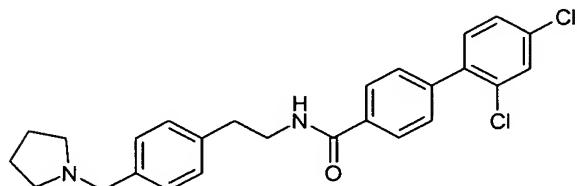
$C_{26}H_{26}Cl_2N_2O$  ( $M= 453.42$ )

calc.: molar peak ( $M+H$ )<sup>+</sup>: 453/455/457      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 453/455/457

- 25    Retention time HPLC: 6.45 min (method A)

**Example 2.59:**

2',4'-dichloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



5

2.59a. 2',4'-dichloro-biphenyl-4-carboxylic acid

Prepared analogously to Example 2.55a from 5.23 g (26.0 mmol) of 4-bromo-benzoic acid and 10.0 g (52.0 mmol) of 2,4-dichlorophenyl-boric acid, refluxing the reaction mixture for 48 h.

10 Yield: 1.5 g (21.6 % of theory)

$C_{13}H_8Cl_2O_2$  ( $M = 267.11$ )

calc.: molar peak ( $M-H^-$ ): 265/267/269      fnd.: molar peak ( $M-H^-$ ): 265/267/269

2.59b. 2',4'-dichloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-15 ethyl]-amide

Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 134 mg (0.5 mmol) of 2',4'-dichloro-biphenyl-4-carboxylic acid.

Yield: 72 mg (31.8 % of theory)

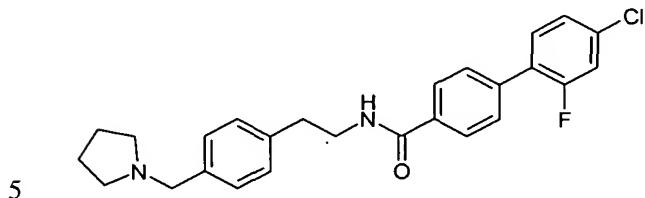
20  $C_{26}H_{26}Cl_2N_2O$  ( $M = 453.42$ )

calc.: molar peak ( $M+H^+$ ): 453/455/457      fnd.: molar peak ( $M+H^+$ ):  
453/455/457

Retention time HPLC: 6.84 min (method A)

**Example 2.60:**

2'-fluoro-4'-chloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.60a. 2'-fluoro-4'-chloro-biphenyl-4-carboxylic acid

Prepared analogously to Example 2.55a from 0.52 g (2.5 mmol) of 1-bromo-4-chloro-2-fluorobenzene and 0.5 g (3.0 mmol) of 4-carboxyphenyl-boric acid.

10 Yield: 0.5 g (79.8 % of theory)

C<sub>13</sub>H<sub>8</sub>ClFO<sub>2</sub> (M= 250.66)

calc.: molar peak (M-H)<sup>-</sup>: 249/251      fnd.: molar peak (M-H)<sup>-</sup>: 249/251

Retention time HPLC: 8.39 min (method A)

15 2.60b. 2'-fluoro-4'-chloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 125 mg (0.5 mmol) of 2'-fluoro-4'-chloro-biphenyl-4-carboxylic acid.

20 Yield: 36 mg (16.5 % of theory)

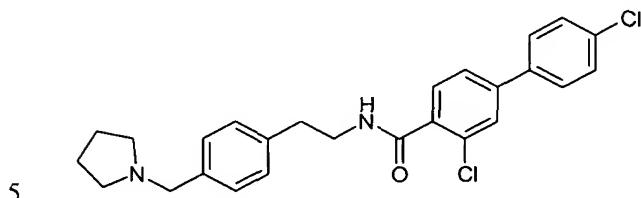
C<sub>26</sub>H<sub>26</sub>ClFN<sub>2</sub>O (M= 436.96)

calc.: molar peak (M+H)<sup>+</sup>: 437/439      fnd.: molar peak (M+H)<sup>+</sup>: 437/439

Retention time HPLC: 6.32 min (method A)

**Example 2.61:**

3,4'-dichloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.61a. 3,4'-dichloro-biphenyl-4-carboxylic acid

Prepared analogously to Example 2.55a from 0.59 g (2.5 mmol) of 4-bromo-2-chloro-benzoic acid and 0.47 g (3.0 mmol) of 4-chlorophenyl-boric acid.

10 Yield: 0.55 g (82.4 % of theory)

$C_{13}H_8Cl_2O_2$  ( $M= 267.11$ )

calc.: molar peak ( $M-H^-$ ): 265/267/269      fnd.: molar peak ( $M-H^-$ ): 265/267/269

Retention time HPLC: 8.83 min (method A)

15 2.61b. 3,4'-dichloro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 134 mg (0.5 mmol) of 3,4'-dichloro-biphenyl-4-carboxylic acid.

20 Yield: 24 mg (10.6 % of theory)

$C_{26}H_{26}Cl_2N_2O$  ( $M= 453.42$ )

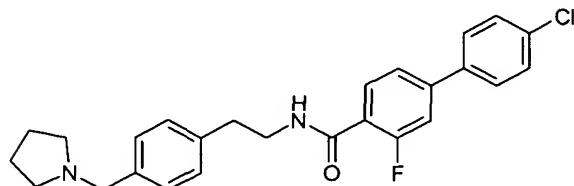
calc.: molar peak ( $M+H^+$ ): 453/455/457      fnd.: molar peak ( $M+H^+$ ): 453/455/457

Retention time HPLC: 6.41 min (method A)

25

**Example 2.62:**

4'-chloro-3-fluoro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



5

2.62a. 4'-chloro-3-fluoro-biphenyl-4-carboxylic acid

Prepared analogously to Example 2.55a from 0.55 g (2.5 mmol) of 4-bromo-2-fluoro-benzoic acid and 0.47 g (3.0 mmol) of 4-chlorophenyl-boric acid.

Yield: 0.60 g (95.7 % of theory)

10 C<sub>13</sub>H<sub>8</sub>ClFO<sub>2</sub> (M= 250.66)

calc.: molar peak (M-H)<sup>-</sup>: 249/251      fnd.: molar peak (M-H)<sup>-</sup>: 249/251

Retention time HPLC: 8.22 min (method A)

2.62b. 4'-chloro-3-fluoro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

15 Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 125 mg (0.5 mmol) of 4'-chloro-3-fluoro-biphenyl-4-carboxylic acid.

Yield: 37 mg (16.9 % of theory)

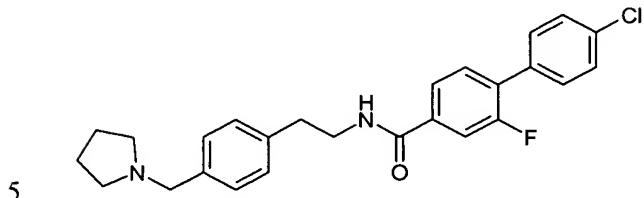
20 C<sub>26</sub>H<sub>26</sub>ClFN<sub>2</sub>O (M= 436.96)

calc.: molar peak (M+H)<sup>+</sup>: 437/439      fnd.: molar peak (M+H)<sup>+</sup>: 437/439

Retention time HPLC: 6.45 min (method A)

**Example 2.63:**

4'-chloro-2-fluoro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.63a. 4'-chloro-2-fluoro-biphenyl-4-carboxylic acid

Prepared analogously to Example 2.55a from 0.66 g (3.0 mmol) of 4-bromo-3-fluoro-benzoic acid and 0.47 g (3.0 mmol) of 4-chlorophenyl-boric acid.

10 Yield: 0.60 g (79.8 % of theory)

$C_{13}H_8ClFO_2$  ( $M= 250.66$ )

calc.: molar peak ( $M-H^-$ ): 249/251      fnd.: molar peak ( $M-H^-$ ): 249/251

Retention time HPLC: 8.50 min (method A)

15 2.63b. 4'-chloro-2-fluoro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 163 mg (0.8 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 201 mg (0.8 mmol) of 4'-chloro-2-fluoro-biphenyl-4-carboxylic acid.

20 Yield: 74 mg (21.2 % of theory)

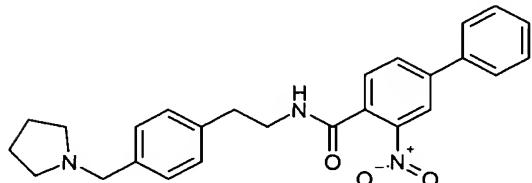
$C_{26}H_{26}ClFN_2O$  ( $M= 436.96$ )

calc.: molar peak ( $M+H^+$ ): 437/439      fnd.: molar peak ( $M+H^+$ ): 437/439

Retention time HPLC: 6.61 min (method A)

**Example 2.64:**

3-nitro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



5

2.64a. 3-nitro-biphenyl-4-carboxylic acid

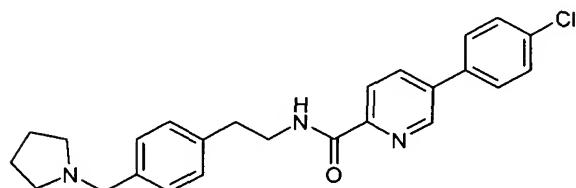
- 150 mg (0.13 mmol) of tetrakis-(triphenylphosphine)-palladium are added to a solution of 1.0 g (4.07 mmol) of 4-bromo-2-nitro-benzoic acid in 20 mL toluene and stirred for 10 min at RT. Then a solution of 0.5 g (4.10 mmol) of phenylboric acid in  
10 10 mL MeOH and a solution of 1.0 g Na<sub>2</sub>CO<sub>3</sub> in 10 mL water are added. The reaction mixture is refluxed for 5 h and stirred at RT over the weekend. The solvents are eliminated in vacuo, the residue is combined with water, acidified with conc. HCl, extracted with EtOAc, the organic phase is dried over Na<sub>2</sub>SO<sub>4</sub> and then the solvent is removed.
- 15 Yield: 0.87 g (87.5 % of theory)  
R<sub>f</sub> value: 0.40 (silica gel, dichloromethane/ethanol 3:1).

2.64b. 3-nitro-biphenyl-4-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

- 20 Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 122 mg (0.5 mmol) of 3-nitro-biphenyl-4-carboxylic acid.  
Yield: 100 mg (46.6 % of theory)  
C<sub>26</sub>H<sub>27</sub>N<sub>3</sub>O<sub>3</sub> (M= 429.52)
- 25 calc.: molar peak (M+H)<sup>+</sup>: 430      fnd.: molar peak (M+H)<sup>+</sup>: 430  
Retention time HPLC: 5.83 min (method A)

**Example 2.65:**

5-(4-chloro-phenyl)-pyridine-2-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



5

2.65a. 5-(4-chloro-phenyl)-pyridine-2-carboxylic acid

Prepared analogously to Example 2.55a from 0.51 g (2.5 mmol) of 5-bromo-pyridine-2-carboxylic acid and 0.47 g (3.0 mmol) of 4-chlorophenyl-boric acid.

Yield: 0.23 g (39.4 % of theory)

10 C<sub>12</sub>H<sub>8</sub>ClNO<sub>2</sub> (M= 233.66)

calc.: molar peak (M-H)<sup>-</sup>: 232/234      fnd.: molar peak (M-H)<sup>-</sup>: 232/234

Retention time HPLC: 5.89 min (method A)

15 2.65b. 5-(4-chloro-phenyl)-pyridine-2-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 116 mg (0.5 mmol) of 5-(4-chlorophenyl)-pyridine-2-carboxylic acid.

Yield: 7 mg (3.3 % of theory)

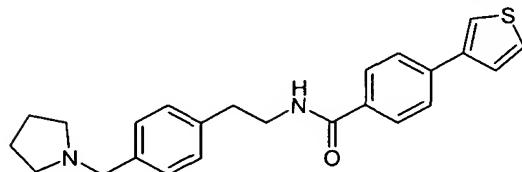
20 C<sub>25</sub>H<sub>26</sub>CIN<sub>3</sub>O (M= 419.96)

calc.: molar peak (M+H)<sup>+</sup>: 420/422      fnd.: molar peak (M+H)<sup>+</sup>: 420/422

Retention time HPLC: 6.40 min (method A)

**Example 2.66:**

N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-4-thiophen-3-yl-benzamide



5

2.66a. 4-thiophen-3-yl-benzoate ethyl

Prepared analogously to Example 2.46b from 414 mg (1.5 mmol) of ethyl 4-iodo-benzoate and 230 mg (1.8 mmol) of thiophene-3-boric acid.

Yield: 348 mg (100 % of theory)

10 C<sub>13</sub>H<sub>12</sub>O<sub>2</sub>S (M= 232.30)

calc.: molar peak (M+H)<sup>+</sup>: 233      fnd.: molar peak (M+H)<sup>+</sup>: 233

Retention time HPLC: 6.20 min (method B)

2.66b. 4-thiophen-3-yl-benzoic acid

15 Prepared analogously to Example 2.7b from 280 mg (1.5 mmol) of ethyl 4-thiophen-3-yl-benzoate .

Yield: 146 mg (59.3 % of theory)

C<sub>11</sub>H<sub>8</sub>O<sub>2</sub>S (M= 204.25)

calc.: molar peak (M-H)<sup>-</sup>: 203      fnd.: molar peak (M-H)<sup>-</sup>: 203

20 Retention time HPLC: 7.60 min (method A)

2.66c. N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-4-thiophen-3-yl-benzamide

Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 102 mg (0.5 mmol) of 4-thiophen-3-yl-benzoic acid.

Yield: 103 mg (53.0 % of theory)

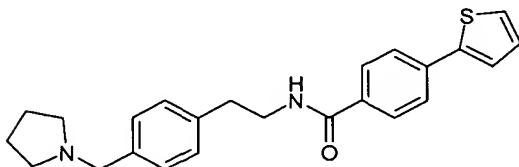
C<sub>24</sub>H<sub>26</sub>N<sub>2</sub>OS (M= 390.55)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 391      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 391

Retention time HPLC: 6.10 min (method A)

**Example 2.67:**

- 5 N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-4-thiophen-2-yl-benzamide



2.67a. ethyl 4-thiophen-2-yl-benzoate

Prepared analogously to Example 2.46b from 414 mg (1.5 mmol) of ethyl 4-iodo-10 benzoate and 230 mg (1.8 mmol) of thiophene-2-boric acid.

Yield: 348 mg (100 % of theory)

$C_{13}H_{12}O_2S$  ( $M= 232.30$ )

calc.: molar peak ( $M+H$ )<sup>+</sup>: 233      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 233

Retention time HPLC: 6.29 min (method B)

15

2.67b. 4-thiophen-2-yl-benzoic acid

Prepared analogously to Example 2.7b from 280 mg (1.5 mmol) of ethyl 4-thiophen-2-yl-benzoate.

Yield: 126 mg (51.2 % of theory)

20  $C_{11}H_8O_2S$  ( $M= 204.25$ )

calc.: molar peak ( $M-H$ )<sup>-</sup>: 203      fnd.: molar peak ( $M-H$ )<sup>-</sup>: 203

Retention time HPLC: 7.60 min (method A)

2.67c. N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-4-thiophen-2-yl-benzamide

25 Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 102 mg (0.5 mmol) of 4-thiophen-2-yl-benzoic acid.

Yield: 112 mg (57.5 % of theory)

C<sub>24</sub>H<sub>26</sub>N<sub>2</sub>OS (M= 390.55)

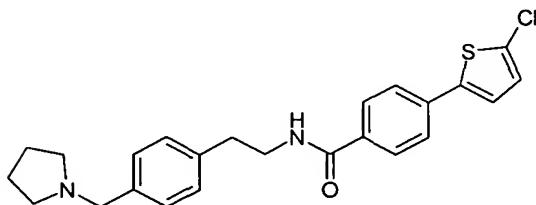
calc.: molar peak (M+H)<sup>+</sup>: 391      fnd.: molar peak (M+H)<sup>+</sup>: 391

Retention time HPLC: 6.05 min (method A)

5

**Example 2.68:**

4-(5-chloro-thiophen-2-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



10 2.68a. 4-(5-chloro-thiophen-2-yl)-benzoic acid

Prepared analogously to Example 2.55a from 300 mg (1.52 mmol) of 2-bromo-5-chlorothiophene and 277 mg (1.67 mmol) of 4-carboxyphenyl-boric acid, using KHSO<sub>4</sub> solution to acidify the worked up reaction mixture.

Yield: 76 mg (21.0 % of theory)

15 C<sub>11</sub>H<sub>7</sub>ClO<sub>2</sub>S (M= 238.69)

calc.: molar peak (M-H)<sup>-</sup>: 237/239      fnd.: molar peak (M-H)<sup>-</sup>: 237/239

Retention time HPLC: 8.75 min (method A)

20 2.68b. 4-(5-chloro-thiophen-2-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

Prepared according to general working method I from 61 mg (0.3 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 71 mg (0.3 mmol) of 4-(5-chlorothiophen-2-yl)-benzoic acid.

Yield: 29 mg (22.9 % of theory)

25 C<sub>24</sub>H<sub>25</sub>CIN<sub>2</sub>OS (M= 425.0)

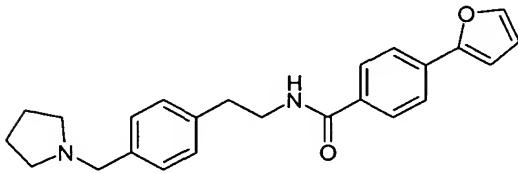
calc.: molar peak (M+H)<sup>+</sup>: 425/427      fnd.: molar peak (M+H)<sup>+</sup>: 425/427

Retention time HPLC: 6.65 min (method A)

**Example 2.69:**

4-furan-2-yl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

5



2.69a. 4-furan-2-yl-benzoic acid

Prepared analogously to Example 2.68a from 302 mg (1.5 mmol) of 4-bromo-benzoic acid and 201 mg (1.8 mmol) of furan-2-boric acid.

10 Yield: 166 mg (58.8 % of theory)

C<sub>11</sub>H<sub>8</sub>O<sub>3</sub> (M= 188.19)

calc.: molar peak (M-H)<sup>-</sup>: 187      fnd.: molar peak (M-H)<sup>-</sup>: 187

Retention time HPLC: 6.82 min (method A)

15 2.69b. 4-furan-2-yl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 94 mg (0.5 mmol) of 4-furan-2-yl-benzoic acid.

Yield: 91 mg (48.4 % of theory)

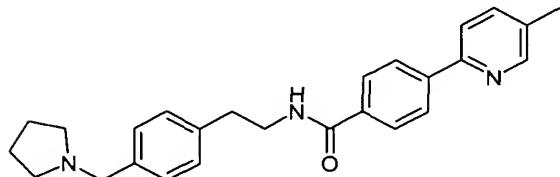
20 C<sub>24</sub>H<sub>26</sub>N<sub>2</sub>O<sub>2</sub> (M= 374.49)

calc.: molar peak (M+H)<sup>+</sup>: 375      fnd.: molar peak (M+H)<sup>+</sup>: 375

Retention time HPLC: 6.48 min (method A)

**Example 2.70:**

4-(5-methyl-pyridin-2-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



5

2.70a. 4-(5-methyl-pyridin-2-yl)-benzoic acid

Prepared analogously to Example 2.55a from 430 mg (2.50 mmol) of 2-bromo-5-methylpyridine and 498 mg (3.00 mmol) of 4-carboxyphenyl-boric acid.

Yield: 300 mg (56.3 % of theory)

10 C<sub>13</sub>H<sub>11</sub>NO<sub>2</sub> (M= 213.24)

calc.: molar peak (M+H)<sup>+</sup>: 214      fnd.: molar peak (M+H)<sup>+</sup>: 214

Retention time HPLC: 4.55 min (method A)

2.70b. 4-(5-methyl-pyridin-2-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-15 benzamide

Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 107 mg (0.5 mmol) of 4-(5-methyl-pyridin-2-yl)-benzoic acid.

Yield: 53 mg (26.5 % of theory)

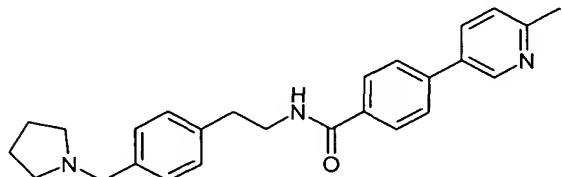
20 C<sub>26</sub>H<sub>29</sub>N<sub>3</sub>O (M= 399.54)

calc.: molar peak (M+H)<sup>+</sup>: 400      fnd.: molar peak (M+H)<sup>+</sup>: 400

Retention time HPLC: 3.98 min (method A)

**Example 2.71:**

4-(6-methyl-pyridin-3-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



5

2.71a. 4-(6-methyl-pyridin-3-yl)-benzoic acid

Prepared analogously to Example 2.55a from 430 mg (2.50 mmol) of 5-bromo-2-methylpyridine and 498 mg (3.00 mmol) of 4-carboxyphenyl-boric acid.

Yield: 300 mg (56.3 % of theory)

10 C<sub>13</sub>H<sub>11</sub>NO<sub>2</sub> (M= 213.24)

calc.: molar peak (M+H)<sup>+</sup>: 214      fnd.: molar peak (M+H)<sup>+</sup>: 214

Retention time HPLC: 2.66 min (method A)

2.71b. 4-(6-methyl-pyridin-3-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-15 benzamide

Prepared according to general working method I from 102 mg (0.5 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 107 mg (0.5 mmol) of 4-(6-methyl-pyridin-3-yl)-benzoic acid.

Yield: 48 mg (24.0 % of theory)

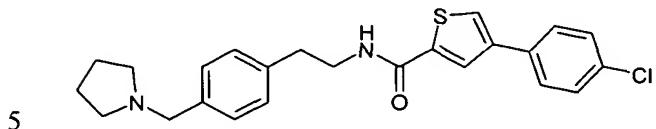
20 C<sub>26</sub>H<sub>29</sub>N<sub>3</sub>O (M= 399.54)

calc.: molar peak (M+H)<sup>+</sup>: 400      fnd.: molar peak (M+H)<sup>+</sup>: 400

Retention time HPLC: 3.06 min (method A)

**Example 2.72:**

4-(4-Chloro-phenyl)-thiophene-2-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.72a. methyl 4-(4-chloro-phenyl)-thiophene-2-carboxylate

420 mg (1.25 mmol) of methyl 4-bromo-thiophene-2-carboxylate are dissolved in 10 mL dioxane and 5 mL 2M Na<sub>2</sub>CO<sub>3</sub> solution. 196 mg (0.06 mmol) of 4-chloro-

10 phenyl-boric acid and 72 mg (0.06 mmol) of tetrakis-(triphenylphosphine)-palladium are added successively, the reaction is refluxed for 6 h and stirred for a further 60 h at RT. After being heated again, the hot reaction solution is suction filtered through a glass fibre filter, washed with dioxane, combined with semisaturated NaHCO<sub>3</sub> solution and extracted with EtOAc. The combined organic phases are dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by column chromatography on silica gel (petroleum ether/ethyl acetate 9:1).

15 Yield: 150 mg (47.3 % of theory)

C<sub>12</sub>H<sub>9</sub>ClO<sub>2</sub>S (M= 252.72)

20 calc.: molar peak (M+H)<sup>+</sup>: 253/255      fnd.: molar peak (M+H)<sup>+</sup>: 253/255

Retention time HPLC: 6.21 min (method B)

2.72b. 4-(4-chloro-phenyl)-thiophene-2-carboxylic acid

2 mL 1M NaOH solution are added to a solution of 150 mg methyl 4-(4-chloro-

25 phenyl)-thiophene-2-carboxylate in 10 mL EtOH and the reaction solution is stirred at RT over the weekend. The solvent is evaporated down in vacuo, the residue combined with 2 mL 1N hydrochloric acid and cooled to 0°C . The precipitated product is suction filtered, washed with water and dried at 50°C.

Yield: 140 mg (98.7 % of theory)

C<sub>11</sub>H<sub>7</sub>ClO<sub>2</sub>S (M= 238.69)

calc.: molar peak (M+H)<sup>+</sup>: 239/241      fnd.: molar peak (M+H)<sup>+</sup>: 239/241

Retention time HPLC: 8.31 min (method A)

- 5 2.72c. 4-(4-chloro-phenyl)-thiophene-2-carboxylic acid [2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 144 mg (0.70 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 140 mg (0.59 mmol) of 4-(4-chloro-phenyl)-thiophene-2-carboxylic acid.

- 10 Yield: 78 mg (31.3 % of theory)

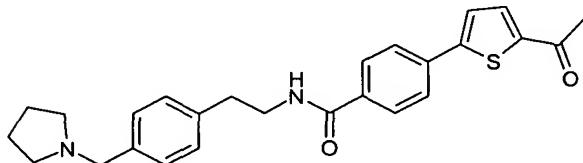
C<sub>26</sub>H<sub>29</sub>N<sub>3</sub>O (M= 425.00)

calc.: molar peak (M+H)<sup>+</sup>: 425/427      fnd.: molar peak (M+H)<sup>+</sup>: 425/427

Retention time HPLC: 3.90 min (method A)

15 **Example 2.73:**

4-(5-acetyl-thiophen-2-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



2.73a. 4-iodo-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

- 20 Prepared according to general working method I from 2.04 g (10.0 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 2.48 g (10.0 mmol) of 4-iodo-benzoic acid.

Yield: 1.91 g (44.0 % of theory)

C<sub>20</sub>H<sub>23</sub>IN<sub>2</sub>O (M= 434.32)

- 25 calc.: molar peak (M+H)<sup>+</sup>: 435      fnd.: molar peak (M+H)<sup>+</sup>: 435

Retention time HPLC: 5.40 min (method A)

2.73b. 4-(5-acetyl-thiophen-2-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

Prepared analogously to Example 2.46b from 250 mg (0.58 mmol) of 4-iodo-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide and 118 mg (0.69 mmol) of 5-

- 5 acetyl-2-thiophene-boric acid, refluxing the reaction mixture for 15 h.

Yield: 50 mg (20.2 % of theory)



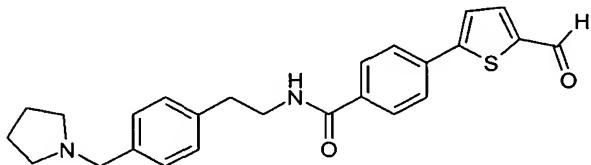
calc.: molar peak (M+H)<sup>+</sup>: 433      fnd.: molar peak (M+H)<sup>+</sup>: 433

Retention time HPLC: 3.91 min (method B)

10

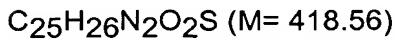
**Example 2.74:**

4-(5-formyl-thiophen-2-yl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



- 15 Prepared analogously to Example 2.46b from 250 mg (0.58 mmol) of 4-iodo-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide and 107 mg (0.69 mmol) of 5-formyl-2-thiophene-boric acid, by refluxing the reaction mixture for 15 h.

Yield: 22 mg (9.1 % of theory)

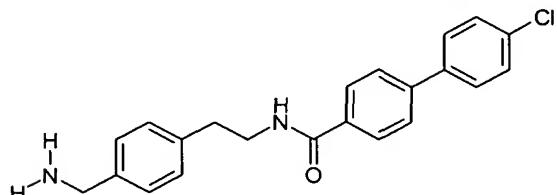


- 20 calc.: molar peak (M+H)<sup>+</sup>: 419      fnd.: molar peak (M+H)<sup>+</sup>: 419

Retention time HPLC: 3.82 min (method B)

**Example 2.75:**

4'-chloro-biphenyl-4-carboxylic acid [2-(4-aminomethyl-phenyl)-ethyl]-amide



- 5 2.75a. ethyl 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoate  
20 mL thionyl chloride and 1 mL DMF are added dropwise to 9.31 g (40mmol) of 4'-chloro-biphenyl-4-carboxylic acid. The reaction mixture is heated to 60°C for 2 h. Then the excess thionyl chloride is eliminated in vacuo at 50°C and the residue is taken up in 200 mL CH<sub>2</sub>Cl<sub>2</sub>. This solution is added dropwise to 9.19 g (40 mmol)
- 10 of ethyl 4-(2-amino-ethyl)-benzoate, used as the hydrochloride, in 100 mL of 10% aqueous Na<sub>2</sub>CO<sub>3</sub> solution and the reaction mixture is stirred for a further hour at RT. After the addition of water and CH<sub>2</sub>Cl<sub>2</sub> the organic phase is separated off, the aqueous phase is extracted with CH<sub>2</sub>Cl<sub>2</sub>, the combined organic phases are washed with semisaturated NaHCO<sub>3</sub> solution and water and dried over MgSO<sub>4</sub>.
- 15 After elimination of the drying agent the solution is filtered through activated charcoal, evaporated down in vacuo and the residue recrystallised from tert-butylmethylether.
- Yield: 11.93 g (73.1 % of theory)  
C<sub>24</sub>H<sub>22</sub>CINO<sub>3</sub> (M= 407.90)
- 20 calc.: molar peak (M+H)<sup>+</sup>: 408      fnd.: molar peak (M+H)<sup>+</sup>: 408  
Retention time HPLC: 9.8 min (method A)

- 2.75b. 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoic acid  
50 mL 2M NaOH solution are added to a solution of 11.93 g (29.25 mmol) of ethyl 25 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoate in 150 mL EtOH and stirred for 2 h at RT. The reaction solution is adjusted to pH 6-7 with 1N HCl solution, the precipitated product is filtered off and dried in the vacuum oven.

Yield: 10.74 g (96.7 % of theory)

C<sub>22</sub>H<sub>18</sub>CINO<sub>3</sub> (M= 379.85)

calc.: molar peak (M+H)<sup>+</sup>: 380/382      fnd.: molar peak (M+H)<sup>+</sup>: 380/382

Retention time HPLC: 8.0 min (method A)

5

2.75c. 4'-chloro-biphenyl-4-carboxylic acid [2-(4-hydroxymethyl-phenyl)-ethyl]-amide

4.82 g (29.69 mmol) of CDI are added to a solution of 10.74 g (28.28 mmol) of 4-{2-[{4'-chloro-biphenyl-4-carbonyl}-amino]-ethyl}-benzoic acid in 150 mL dry THF  
10 and the reaction mixture is heated to 50°C for 2 h. This solution is added to a suspension of 2.14 g (56.56 mmol) of NaBH<sub>4</sub> in 5 mL water and stirred vigorously for a further hour at RT. Using 1N HCl the pH of the solution is adjusted to 6, it is then combined with EtOAc and filtered. The filtrate is washed with semisaturated NaHCO<sub>3</sub> solution and water and dried over MgSO<sub>4</sub>. As the residue still contains  
15 unreacted 4-{2-[{4'-chloro-biphenyl-4-carbonyl}-amino]-ethyl}-benzoic acid after elimination of the drying agent and solvent the above reduction step is repeated. The product obtained is dried at 40°C.

Yield: 9.3 g (89.9 % of theory)

C<sub>22</sub>H<sub>20</sub>CINO<sub>2</sub> (M= 365.86)

20 calc.: molar peak (M+H)<sup>+</sup>: 366/368      fnd.: molar peak (M+H)<sup>+</sup>: 366/368

Retention time HPLC: 8.11 min (method A)

2.75d. 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide

1.22 ml PBr<sub>3</sub> are added dropwise to a solution of 7.9 g (21.59 mmol) of 4'-chloro-  
25 biphenyl-4-carboxylic acid [2-(4-hydroxymethyl-phenyl)-ethyl]-amide in 300 mL CH<sub>2</sub>Cl<sub>2</sub>. The reaction mixture is stirred overnight at RT. The precipitate formed is suction filtered and the filtrate evaporated down. The residue is triturated with a little acetonitrile and CH<sub>2</sub>Cl<sub>2</sub>, suction filtered, combined with the precipitate obtained at first and dried in the air.

30 Yield: 8.6 g (92.9 % of theory)

C<sub>22</sub>H<sub>19</sub>BrCINO (M= 428.76)

calc.: molar peak (M+H)<sup>+</sup>: 428/430/432  
428/430/432

fld.: molar peak (M+H)<sup>+</sup>:

R<sub>f</sub> value: 0.40 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>).

5

2.75e. 4'-chloro-biphenyl-4-carboxylic acid [2-(4-aminomethyl-phenyl)-ethyl]-amide  
3 mL of a 0.5 M NH<sub>3</sub> solution in dioxane are added to a solution of 150 mg (0.35  
mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-  
amide in 10 mL acetonitrile and stirred for 3 days at RT. The reaction mixture is  
10 evaporated down and the residue purified by column chromatography (silica gel,  
CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

Yield: 8 mg (6.3 % of theory)

C<sub>22</sub>H<sub>21</sub>CIN<sub>2</sub>O (M= 364.88)

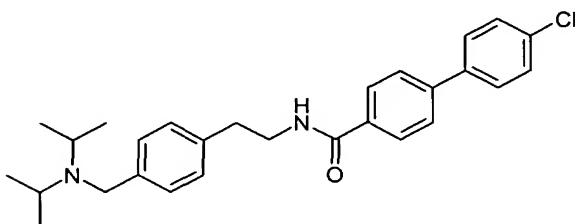
calc.: molar peak (M+H)<sup>+</sup>: 365/367      fld.: molar peak (M+H)<sup>+</sup>: 365/367

15 Retention time HPLC: 5.97 min (method A)

**Example 2.76:**

4'-chloro-biphenyl-4-carboxylic acid (2-{4-[{diisopropylamino}-methyl]-phenyl}-  
ethyl)-amide

20



47  $\mu$ L (0.33 mmol) of diisopropylamine are added to a suspension of 129 mg (0.3  
mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-  
amide and 55 mg (0.4 mmol) of K<sub>2</sub>CO<sub>3</sub> in 20 mL acetonitrile and the reaction  
25 mixture is stirred overnight at RT. It is diluted with CH<sub>2</sub>Cl<sub>2</sub>, filtered to remove

insoluble inorganic salts and the filtrate is evaporated down. The residue is triturated with acetonitrile, suction filtered and dried in the air.

Yield: 75 mg (55.7 % of theory)

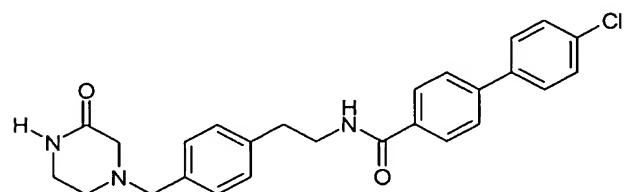
C<sub>28</sub>H<sub>33</sub>ClN<sub>2</sub>O (M= 449.04)

5 calc.: molar peak (M+H)<sup>+</sup>: 449/451      fdn.: molar peak (M+H)<sup>+</sup>: 449/451

R<sub>f</sub> value: 0.35 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 95:5:0.5).

**Example 2.77:**

4'-chloro-biphenyl-4-carboxylic acid {2-[4-(3-oxo-piperazin-1-ylmethyl)-phenyl]-10 ethyl}-amide



Prepared analogously to Example 2.76 from 129 mg (0.3 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide and 33 mg (0.33 mmol) of piperazine-2-one.

15 Yield: 23 mg (17.1 % of theory)

C<sub>26</sub>H<sub>26</sub>ClN<sub>3</sub>O<sub>2</sub> (M= 447.97)

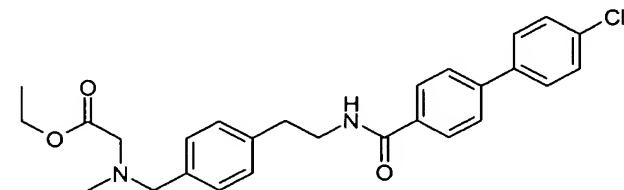
calc.: molar peak (M+H)<sup>+</sup>: 448/450      fdn.: molar peak (M+H)<sup>+</sup>: 448/450

R<sub>f</sub> value: 0.10 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 95:5:0.5).

20

**Example 2.78:**

Ethyl [(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-methyl-amino]-acetate



Prepared analogously to Example 2.76 from 257 mg (0.6 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide, 193 mg K<sub>2</sub>CO<sub>3</sub> and 101 mg (0.66 mmol) of ethyl methylamino-acetate (used as the hydrochloride).

5 Yield: 152 mg (54.5 % of theory)



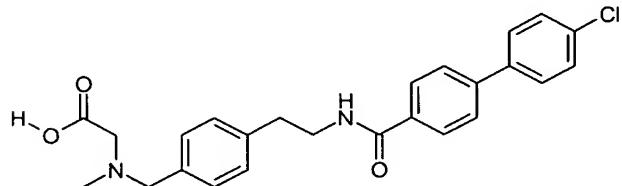
calc.: molar peak (M+H)<sup>+</sup>: 465/467 fnd.: molar peak (M+H)<sup>+</sup>: 465/467

R<sub>f</sub> value: 0.40 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 95:5:0.5).

10

**Example 2.79:**

[(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-methyl-amino]-acetic acid

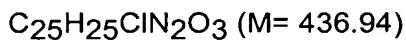


15

0.3 mL 1M NaOH solution are added to a solution of 80 mg (0.17 mmol) of ethyl [(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-methyl-amino]-acetate in 3 mL EtOH and refluxed for 1 h. The solvent is evaporated down in vacuo and the residue combined with water and 0.3 mL 1 M HCl. The precipitate is suction filtered and dried at 40°C.

20

Yield: 76 mg (100 % of theory)

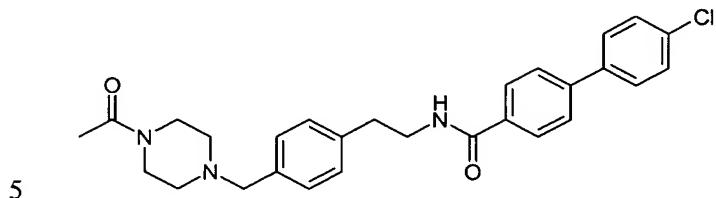


calc.: molar peak (M+H)<sup>+</sup>: 437/439 fnd.: molar peak (M+H)<sup>+</sup>: 437/439

Retention time HPLC: 6.35 min (method A)

**Example 2.80:**

4'-chloro-biphenyl-4-carboxylic acid{2-[4-(4-acetyl-piperazin-1-ylmethyl)-phenyl]-ethyl}-amide



Prepared analogously to Example 2.76 from 129 mg (0.3 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide and 42 mg (0.33 mmol) of 1-piperazin-1-yl-ethanone.

10 Yield: 60 mg (42.0 % of theory)

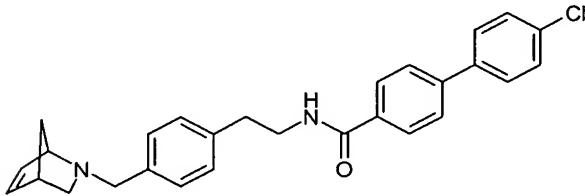
$C_{28}H_{30}ClN_3O_2$  ( $M = 476.02$ )

calc.: molar peak  $(M+H)^+$ : 476/478      fnd.: molar peak  $(M+H)^+$ : 476/478

$R_f$  value: 0.15 (silica gel,  $CH_2Cl_2/MeOH/NH_3$  95:5:0.5).

15 **Example 2.81:**

4'-Chloro-biphenyl-4-carboxylic acid{2-[4-(2-aza-bicyclo[2.2.1]hept-5-en-2-ylmethyl)-phenyl]-ethyl}-amide



20 Prepared analogously to Example 2.76 from 129 mg (0.3 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide and 31 mg (0.33 mmol) of 2-aza-bicyclo[2.2.1]hept-5-ene.

Yield: 100 mg (75.2 % of theory)

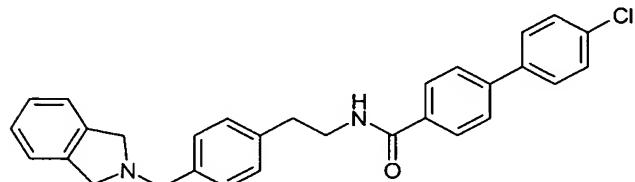
$C_{28}H_{27}ClN_2O$  ( $M = 442.99$ )

calc.: molar peak ( $M+H$ )<sup>+</sup>: 443/445      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 443/445

$R_f$  value: 0.08 (silica gel,  $CH_2Cl_2/MeOH/NH_3$  95:5:0.5).

**Example 2.82:**

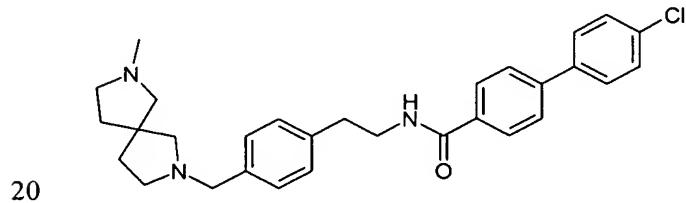
- 5 4'-chloro-biphenyl-4-carboxylic acid-{2-[4-(1,3-dihydro-isoindol-2-ylmethyl)-phenyl]-ethyl}-amide



- Prepared analogously to Example 2.76 from 129 mg (0.3 mmol) of 4'-chloro-  
10 biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide, 97 mg  $K_2CO_3$   
and 51 mg (0.33 mmol) of 2,3-dihydro-1H-isoindole (used as the hydrochloride).  
Yield: 80 mg (57.1 % of theory)  
 $C_{30}H_{27}ClN_2O$  ( $M= 467.02$ )  
calc.: molar peak ( $M+H$ )<sup>+</sup>: 467/469      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 467/469  
15  $R_f$  value: 0.40 (silica gel,  $CH_2Cl_2/MeOH/NH_3$  95:5:0.5).

**Example 2.83:**

4'-chloro-biphenyl-4-carboxylic acid-{2-[4-(7-methyl-2.7-diaza-spiro[4.4]non-2-ylmethyl)-phenyl]-ethyl}-amide



- 20 Prepared analogously to Example 2.76 from 129 mg (0.3 mmol) of 4'-chloro-  
biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide and 46 mg  
(0.33 mmol) of 2-methyl-2.7-diaza-spiro[4.4]nonane.

Yield: 42 mg (28.7 % of theory)

C<sub>30</sub>H<sub>34</sub>CIN<sub>3</sub>O (M= 488.08)

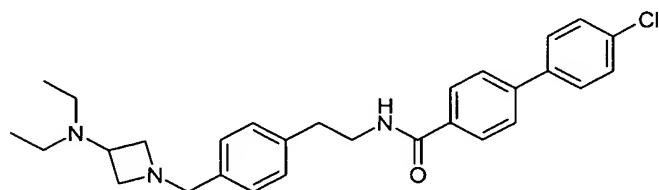
calc.: molar peak (M+H)<sup>+</sup>: 488/490      fnd.: molar peak (M+H)<sup>+</sup>: 488/490

R<sub>f</sub> value: 0.05 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 95:5:0.5).

5

**Example 2.84:**

4'-chloro-biphenyl-4-carboxylic acid-{2-[4-(3-diethylamino-azetidin-1-ylmethyl)-phenyl]-ethyl}-amide



10

Prepared analogously to Example 2.76 from 129 mg (0.3 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide, 138 mg K<sub>2</sub>CO<sub>3</sub> and 66 mg (0.33 mmol) of azetidin-3-yl-diethyl-amine (used as bis-hydrochloride); the product is purified by column chromatography.

15

Yield: 15 mg (10.5 % of theory)

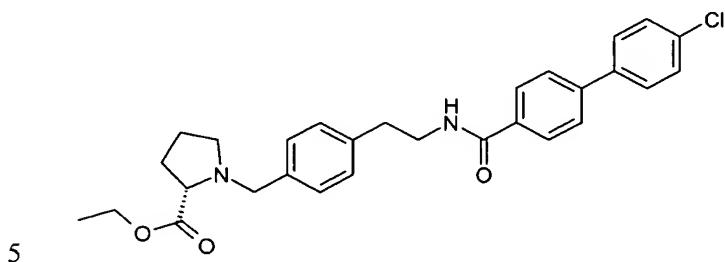
C<sub>29</sub>H<sub>34</sub>CIN<sub>3</sub>O (M= 476.07)

calc.: molar peak (M+H)<sup>+</sup>: 476/478      fnd.: molar peak (M+H)<sup>+</sup>: 476/478

R<sub>f</sub> value: 0.10 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 95:5:0.1).

**Example 2.85:**

Ethyl (S)-1-(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-pyrrolidine-2-carboxylate



Prepared analogously to Example 2.76 from 257 mg (0.6 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide, 193 mg K<sub>2</sub>CO<sub>3</sub> and 119 mg (0.66 mmol) of ethyl (S)-pyrrolidine-2-carboxylate (used as the hydrochloride); the product is purified by column chromatography.

10 Yield: 160 mg (54.3 % of theory)

C<sub>29</sub>H<sub>31</sub>ClN<sub>2</sub>O<sub>3</sub> (M= 491.04)

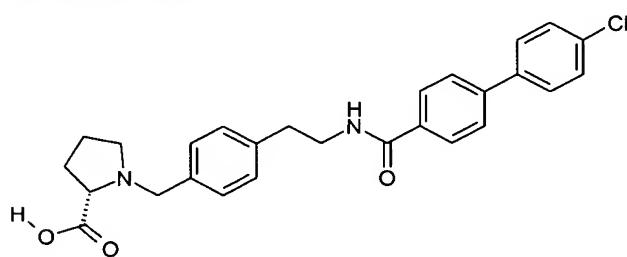
calc.: molar peak (M+H)<sup>+</sup>: 491/493      fnd.: molar peak (M+H)<sup>+</sup>: 491/493

R<sub>f</sub> value: 0.60 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 95:5:0.5).

15

**Example 2.86:**

(S)-1-(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-pyrrolidine-2-carboxylic acid



20

Prepared analogously to Example 2.79 from 130 mg (0.27 mmol) of ethyl (S)-1-(4-{2-[{(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl}-pyrrolidine-2-carboxylate.

Yield: 120 mg (97.8 % of theory)

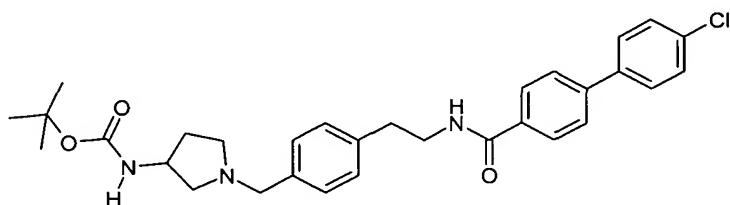
C<sub>27</sub>H<sub>27</sub>CIN<sub>2</sub>O<sub>3</sub> (M= 462.98)

5 calc.: molar peak (M+H)<sup>+</sup>: 463/465      fnd.: molar peak (M+H)<sup>+</sup>: 463/465

Retention time HPLC: 6.20 min (method A)

**Example 2.87:**

Tert.butyl [1-(4-{2-[{(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl}-pyrrolidin-10 3-yl]-carbaminate



Prepared analogously to Example 2.76 from 429 mg (1.0 mmol) of 4'-chlorobiphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide and 205 mg (1.10 mmol) of tert.butyl pyrrolidin-3-yl-carbaminate.

Yield: 500 mg (93.6 % of theory)

C<sub>31</sub>H<sub>36</sub>CIN<sub>3</sub>O<sub>3</sub> (M= 534.10)

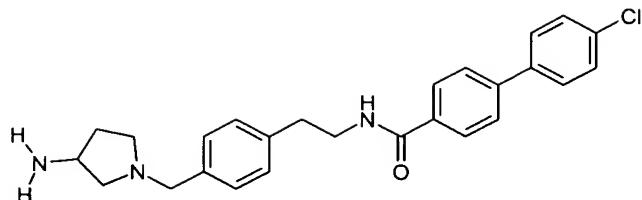
calc.: molar peak (M+H)<sup>+</sup>: 534/536      fnd.: molar peak (M+H)<sup>+</sup>: 534/536

R<sub>f</sub> value: 0.33 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 95:5:0.5).

20

**Example 2.88:**

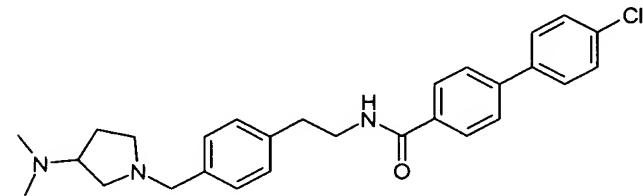
4'-chloro-biphenyl-4-carboxylic acid{2-[4-(3-amino-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide



- 1 mL trifluoroacetic acid are added to a solution of 500 mg (0.94 mmol) of tert.butyl [1-(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-pyrrolidin-3-yl]-carbaminate in 15 mL CH<sub>2</sub>Cl<sub>2</sub> and the reaction mixture is stirred overnight. This is then evaporated down, the residue taken up in a little CH<sub>2</sub>Cl<sub>2</sub> and combined with semisaturated NaHCO<sub>3</sub> solution. The precipitated product is suction filtered, triturated with acetonitrile and dried at 40°C.
- 5 Yield: 240 mg (59.1 % of theory)
- 10 C<sub>26</sub>H<sub>28</sub>CIN<sub>3</sub>O (M= 433.99)
- calc.: molar peak (M+H)<sup>+</sup>: 434/436      fnd.: molar peak (M+H)<sup>+</sup>: 434/436
- R<sub>f</sub> value: 0.22 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

**Example 2.89:**

- 15 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(3-dimethylamino-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide



- 20 0.12 mL 37% aqueous formaldehyde solution, 28 mg (0.45 mmol) of NaBH<sub>3</sub>CN and one drop of glacial acetic acid are added to a solution of 60 mg (0.14 mmol) of 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(3-amino-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide in 5 mL acetonitrile. The reaction mixture is stirred overnight at RT and then combined with dilute NaOH solution and EtOAc. The phases are

separated, the organic phase is dried over MgSO<sub>4</sub> and then freed from drying agent and solvent. The residue is purified by column chromatography.

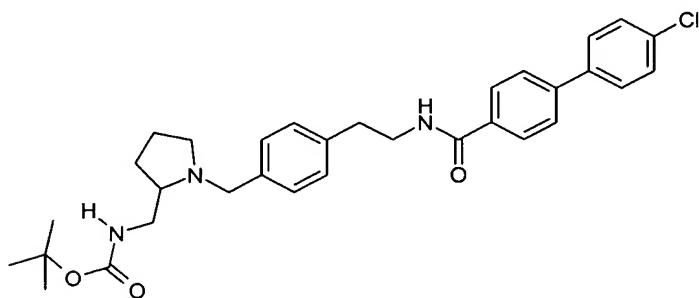
Yield: 10 mg (15.7 % of theory)

C<sub>28</sub>H<sub>32</sub>CIN<sub>3</sub>O (M= 462.04)

5 calc.: molar peak (M+H)<sup>+</sup>: 462/464      fnd.: molar peak (M+H)<sup>+</sup>: 462/464  
Retention time HPLC: 5.16 min (method A)

**Example 2.90:**

10 tert.butyl [1-(4-{2-[{(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl}-pyrrolidin-2-ylmethyl]-carbaminate



Prepared analogously to Example 2.76 from 230 mg (0.54 mmol) of 4'-chlorobiphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide and 116 mg (1.10 mmol) of tert.butyl pyrrolidin-2-ylmethyl-carbaminate.

15 Yield: 230 mg (78.3 % of theory)

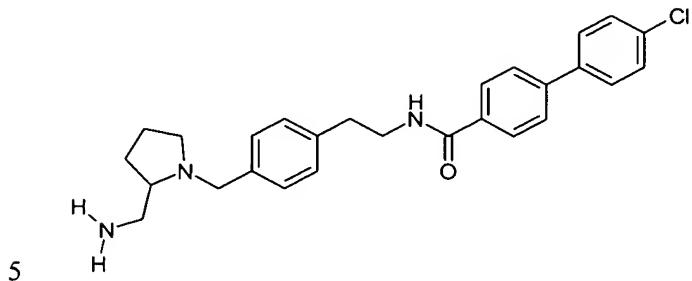
C<sub>32</sub>H<sub>38</sub>CIN<sub>3</sub>O<sub>3</sub> (M= 548.13)

calc.: molar peak (M+H)<sup>+</sup>: 548/550      fnd.: molar peak (M+H)<sup>+</sup>: 548/550

R<sub>f</sub> value: 0.35 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 95:5:0.5).

**Example 2.91:**

4'-chloro-biphenyl-4-carboxylic acid{2-[4-(2-aminomethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide



Prepared analogously to Example 2.88 from 230 mg (0.42 mmol) of tert.butyl [1-(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-pyrrolidin-2-ylmethyl]-carbaminate

10 Yield: 188 mg (100 % of theory)

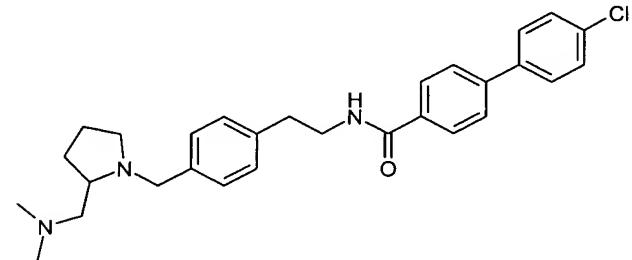
C<sub>27</sub>H<sub>30</sub>ClN<sub>3</sub>O (M= 448.01)

calc.: molar peak (M+H)<sup>+</sup>: 448/450      fnd.: molar peak (M+H)<sup>+</sup>: 448/450

R<sub>f</sub> value: 0.35 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

15 **Example 2.92:**

4'-chloro-biphenyl-4-carboxylic acid{2-[4-(2-dimethylaminomethyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide



20 Prepared analogously to Example 2.89 from 40 mg (0.09 mmol) of 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(2-aminomethyl-pyrrolidin-1-ylmethyl)-phenyl]-

ethyl}-amide, 0.08 mL 37% aqueous formaldehyde solution and 19 mg (0.30 mmol) of NaBH<sub>3</sub>CN .

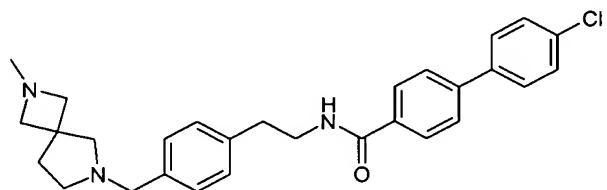
Yield: 10 mg (23.6 % of theory)

C<sub>29</sub>H<sub>34</sub>CIN<sub>3</sub>O (M= 476.07)

5 calc.: molar peak (M+H)<sup>+</sup>: 476/478      fnd.: molar peak (M+H)<sup>+</sup>: 476/478  
R<sub>f</sub> value: 0.12 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

**Example 2.93:**

10 4'-chloro-biphenyl-4-carboxylic acid{2-[4-(2-methyl-2,6-diaza-spiro[3.4]oct-6-ylmethyl)-phenyl]-ethyl}-amide



Prepared analogously to Example 2.76 from 250 mg (0.58 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide, 97 mg K<sub>2</sub>CO<sub>3</sub> and 81 mg (0.64 mmol) of 2-methyl-2,6-diaza-spiro[3.4]octane; the product is  
15 purified by HPLC.

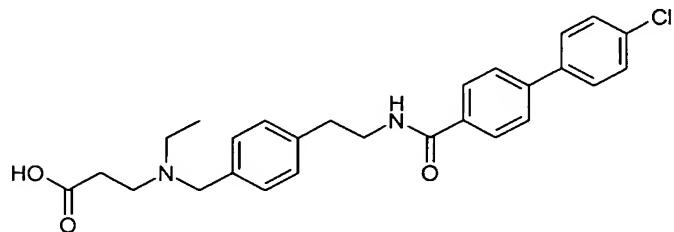
Yield: 20 mg (7.2 % of theory)

C<sub>29</sub>H<sub>32</sub>CIN<sub>3</sub>O (M= 474.05)

calc.: molar peak (M+H)<sup>+</sup>: 474/476      fnd.: molar peak (M+H)<sup>+</sup>: 474/476  
20 R<sub>f</sub> value: 0.20 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

**Example 2.94:**

3-[(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-ethyl-amino]-propionic acid

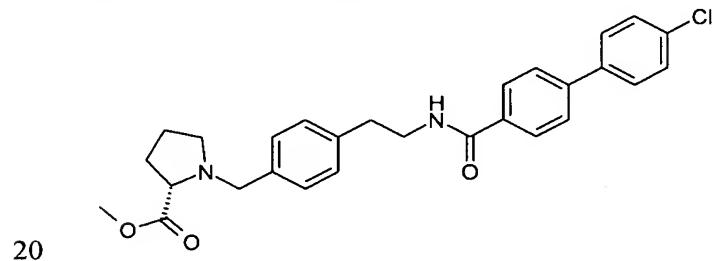


5

- A suspension of 257 mg (0.6 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-bromomethyl-phenyl)-ethyl]-amide, 166 mg (1.2 mmol) of  $K_2CO_3$  and 138 mg 3-ethylamino-propionic acid (0.9 mmol, used as the hydrochloride) in 20 mL acetonitrile is stirred for 3 days at RT. 5 mL of DMF are added and the mixture is heated to 50°C for 3 h. The reaction mixture is filtered, the filtrate evaporated down and the residue is purified by HPLC.
- Yield: 50 mg (17.9 % of theory)
- $C_{27}H_{29}ClN_2O_3$  ( $M= 465.0$ )
- calc.: molar peak  $(M+H)^+$ : 465/467      fnd.: molar peak  $(M+H)^+$ : 465/467
- 15      Retention time HPLC: 5.85 min (method A)

**Example 2.95:**

methyl (S)-1-(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-pyrrolidine-2-carboxylate



20

2.95a. ethyl 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoate

Prepared according to general working method I from 10.0 g (42.98 mmol) of 4'-chloro-biphenyl-4-carboxylic acid and 9.87 g (42.98 mmol) of ethyl 4-(2-aminoethyl)-benzoate .

Yield: 10.64 g (60.7 % of theory)

5 C<sub>24</sub>H<sub>22</sub>CINO<sub>3</sub> (M= 407.90)

calc.: molar peak (M+H)<sup>+</sup>: 408/410      fnd.: molar peak (M+H)<sup>+</sup>: 408/410

R<sub>f</sub> value: 0.87 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 95:5).

2.95b. 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoic acid

10 14 mL 2 M NaOH solution are added to a solution of 10.64 g (26.08 mmol) of ethyl 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoate in 100 mL EtOH and the reaction mixture is heated to 60°C overnight. Then a further 30 mL of NaOH solution are added and the mixture is kept at this temperature for a further 3 h. The reaction mixture is adjusted to pH 6-7 with 1M-HCl solution, the precipitated  
15 product is filtered off and dried in vacuo.

Yield: 7.65 g (77.2 % of theory)

C<sub>22</sub>H<sub>18</sub>CINO<sub>3</sub> (M= 379.85)

calc.: molar peak (M+H)<sup>+</sup>: 380/382      fnd.: molar peak (M+H)<sup>+</sup>: 380/382

Retention time HPLC: 8.1 min (method A)

20 2.95c. 4'-chloro-biphenyl-4-carboxylic acid [2-(4-hydroxymethyl-phenyl)-ethyl]-amide  
3.24 g (20 mmol) of CDI are added to a solution of 7.2 g (18.97 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoic acid in 150 mL dry THF and the  
25 reaction mixture is heated to 50°C for 2 h. This solution is added to a suspension of 1.44 g (38 mmol) of NaBH<sub>4</sub> in 5 mL water and stirred for a further hour. The reaction mixture is adjusted to pH 6-7 with 1M HCl solution and exhaustively extracted with EtOAc. The organic phase is washed with NaHCO<sub>3</sub> solution and with water and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent  
30 the residue is purified by chromatography (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 9:1). As there

is still educt in the product, the procedure described above is repeated with 50% of the reagents used.

Yield: 2.85 g (41.0 % of theory)

C<sub>22</sub>H<sub>20</sub>CINO<sub>2</sub> (M= 365.86)

5 calc.: molar peak (M+H)<sup>+</sup>: 366/368      fdn.: molar peak (M+H)<sup>+</sup>: 366/368  
Retention time HPLC: 8.0 min (method A)

2.95d. 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate

10 1.25 mL (9 mmol) of triethylamine are added to a solution of 1.0 g (2.73 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(4-hydroxymethyl-phenyl)-ethyl]-amide in 100 mL dry THF and the mixture is cooled to -20°C. Then 0.64 mL (8.2 mmol) of methanesulphonic acid chloride are added dropwise and the mixture is stirred for a further 2 h at this temperature. 5% NaHCO<sub>3</sub> solution is added and the mixture is extracted exhaustively with EtOAc. The organic phase is dried over Na<sub>2</sub>SO<sub>4</sub>, the drying agent and solvent removed and the residue dried at 30°C in vacuo.

15 Yield: 1.21 g (99.7 % of theory)

C<sub>23</sub>H<sub>22</sub>CINO<sub>4</sub>S (M= 443.95)

calc.: molar peak (M+H)<sup>+</sup>: 444/446      fdn.: molar peak (M+H)<sup>+</sup>: 444/446  
20 Retention time HPLC: 8.8 min (method A)

2.95e. methyl (S)-1-(4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl)-pyrrolidine-2-carboxylate

Under an N<sub>2</sub> atmosphere a solution of 50 mg (0.3 mmol) of methyl (2S)-25 pyrrolidine-2-carboxylate (used as the hydrochloride) and 0.7 mL (0.5 mmol) of triethylamine in 4 mL DMF is stirred for 20 min at RT. Then 111 mg (0.25 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate are added and the mixture is heated to 60°C for 2 h. The reaction mixture is evaporated down in vacuo and the residue purified by HPLC.

30 Yield: 4 mg (3.4 % of theory)

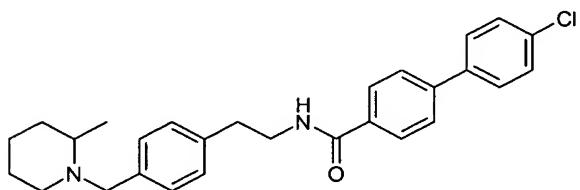
C<sub>28</sub>H<sub>29</sub>ClN<sub>2</sub>O<sub>3</sub> (M= 477.01)

calc.: molar peak (M+H)<sup>+</sup>: 477/479      fnd.: molar peak (M+H)<sup>+</sup>: 477/479

Retention time HPLC: 6.51 min (method A)

5   **Example 2.96:**

4'-chloro-biphenyl-4-carboxylic acid {2-[4-(2-methyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide



- 10   Prepared analogously to Example 2.95e from 111 mg (0.42 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate and 35  $\mu$ L (0.3 mmol) of 2-methylpiperidine without using triethylamine.

Yield: 7 mg (6.3 % of theory)

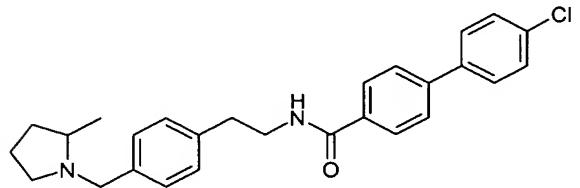
C<sub>28</sub>H<sub>31</sub>ClN<sub>2</sub>O (M= 447.03)

- 15   calc.: molar peak (M+H)<sup>+</sup>: 447/449      fnd.: molar peak (M+H)<sup>+</sup>: 447/449

Retention time HPLC: 6.4 min (method A)

**Example 2.97:**

- 20   4'-chloro-biphenyl-4-carboxylic acid {2-[4-(2-methyl-pyrrolidin-1-ylmethyl)-phenyl]-ethyl}-amide



Prepared analogously to Example 2.95e from 111 mg (0.42 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate and 32  $\mu$ L (0.3 mmol) of 2-methyl- pyrrolidine without using triethylamine.

Yield: 2 mg (1.8 % of theory)

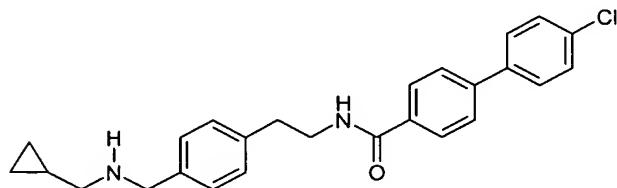
5 C<sub>27</sub>H<sub>29</sub>CIN<sub>2</sub>O (M= 433.0)

calc.: molar peak (M+H)<sup>+</sup>: 433/435      fnd.: molar peak (M+H)<sup>+</sup>: 433/435

Retention time HPLC: 6.3 min (method A)

**Example 2.98:**

10 4'-chloro-biphenyl-4-carboxylic acid (2-{4-[(cyclopropylmethyl-amino)-methyl]-phenyl}-ethyl)-amide



Prepared analogously to Example 2.95e from 111 mg (0.42 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate and 26  $\mu$ L (0.3 mmol) of cyclopropylmethylamine without using triethylamine.

Yield: 4 mg (3.8 % of theory)

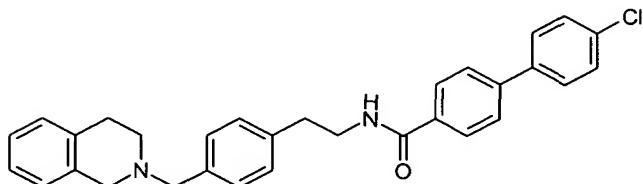
C<sub>26</sub>H<sub>27</sub>CIN<sub>2</sub>O (M= 418.97)

calc.: molar peak (M+H)<sup>+</sup>: 418/420      fnd.: molar peak (M+H)<sup>+</sup>: 418/420

20 Retention time HPLC: 6.4 min (method A)

**Example 2.99:**

4'-chloro-biphenyl-4-carboxylic acid {2-[4-(3,4-dihydro-1H-isoquinolin-2-ylmethyl)-phenyl]-ethyl}-amide



5

Prepared analogously to Example 2.95e from 111 mg (0.42 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate and 40 mg (0.3 mmol) of 1,2,3,4-tetrahydroisoquinoline without using triethylamine.

Yield: 21 mg (17.5 % of theory)

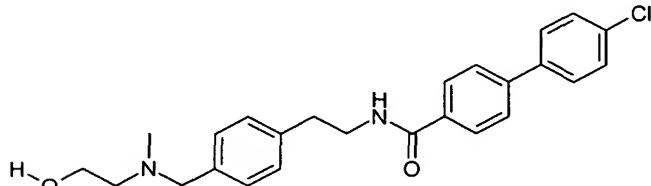
10 C<sub>26</sub>H<sub>27</sub>CIN<sub>2</sub>O (M= 481.04)

calc.: molar peak (M+H)<sup>+</sup>: 481/483      fnd.: molar peak (M+H)<sup>+</sup>: 481/483

Retention time HPLC: 6.8 min (method A)

**Example 2.100:**

15 4'-chloro-biphenyl-4-carboxylic acid [2-(4-{[(2-hydroxy-ethyl)-methyl-amino]-methyl}-phenyl)-ethyl]-amide



Prepared analogously to Example 2.95e from 111 mg (0.42 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate and 24 µL (0.3 mmol) of 2-methylamino-ethanol without using triethylamine.

Yield: 13 mg (12.3 % of theory)

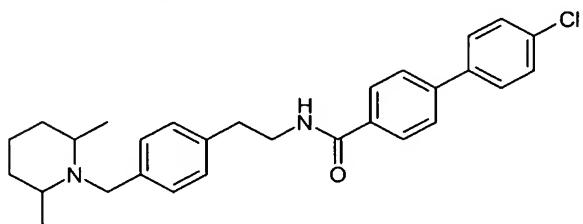
C<sub>25</sub>H<sub>27</sub>CIN<sub>2</sub>O<sub>2</sub> (M= 422.96)

calc.: molar peak (M+H)<sup>+</sup>: 423/425      fnd.: molar peak (M+H)<sup>+</sup>: 423/425

Retention time HPLC: 5.8 min (method A)

**Example 2.101:**

- 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(2,6-dimethyl-piperidin-1-ylmethyl)-phenyl]-ethyl}-amide  
5



Prepared analogously to Example 2.95e from 111 mg (0.42 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate and 41  $\mu$ L (0.3 mmol) of 2,6-dimethylpiperidine without using triethylamine.

- 10 Yield: 8 mg (6.9 % of theory)

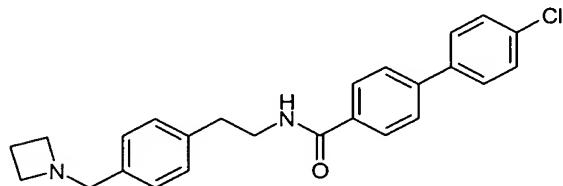


calc.: molar peak  $(M+H)^+$ : 461/463      fnd.: molar peak  $(M+H)^+$ : 461/463

Retention time HPLC: 6.6 min (method A)

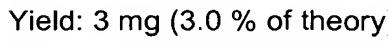
15 **Example 2.102:**

- 4'-chloro-biphenyl-4-carboxylic acid [2-(4-azetidin-1-ylmethyl-phenyl)-ethyl]-amide



Prepared analogously to Example 2.95e from 111 mg (0.42 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate and 20  $\mu$ L (0.3 mmol) of azetidine without using triethylamine.

- 20 Yield: 3 mg (3.0 % of theory)



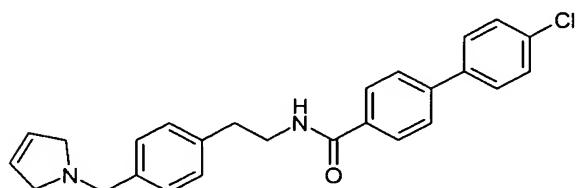
calc.: molar peak  $(M+H)^+$ : 405/407      fnd.: molar peak  $(M+H)^+$ : 405/407

Retention time HPLC: 5.9 min (method A)

**Example 2.103:**

4'-chloro-biphenyl-4-carboxylic acid {2-[4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-

5 ethyl}-amide



Prepared analogously to Example 2.95e from 50 mg (0.11 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzyl methanesulphonate and 11  $\mu$ L (0.14 mmol) of 2,5-dihydro-1H-pyrrole without using triethylamine.

10 Yield: 18 mg (38.2 % of theory)

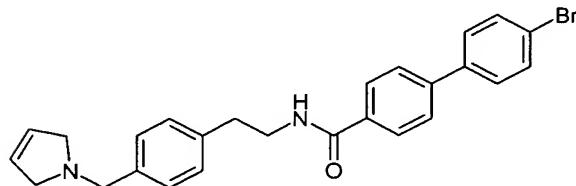
$C_{26}H_{25}ClN_2O$  ( $M= 416.95$ )

calc.: molar peak  $(M+H)^+$ : 417/419      fnd.: molar peak  $(M+H)^+$ : 417/419

Retention time HPLC: 6.2 min (method A)

15 **Example 2.104:**

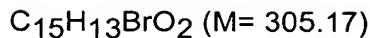
4'-bromo-biphenyl-4-carboxylic acid {2-[4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-amide



20 2.104a. ethyl 4'-bromo-biphenyl-4-carboxylate

Prepared analogously to Example 2.46b from 1.22 mL (7.47 mmol) of ethyl 4-bromo-benzoate and 1.8 g (8.96 mmol) of 4-bromophenyl-boric acid, refluxing for 72 h. The product is crystallised from acetonitrile.

Yield: 293 mg (12.8 % of theory)



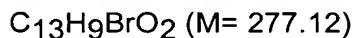
calc.: molar peak (M+H)<sup>+</sup>: 304/306      fnd.: molar peak (M+H)<sup>+</sup>: 304/306

R<sub>f</sub> value: 0.9 (silica gel, petroleum ether/EtOAc 6:4).

5    2.104b. 4'-bromo-biphenyl-4-carboxylic acid

1.24 mL 2M NaOH solution are added to a solution of 270 mg (0.89 mmol) of ethyl 4'-bromo-biphenyl-4-carboxylate in 10 mL EtOH and the reaction mixture is stirred for 2 h at RT. The pH is adjusted to 6-7 with 1 M HCl, the precipitated product is filtered off and dried.

10   Yield: 205 mg (83.6 % of theory)



calc.: molar peak (M-H)<sup>-</sup>: 275/277      fnd.: molar peak (M-H)<sup>-</sup>: 275/277

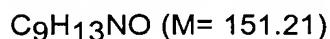
Retention time HPLC: 8.5 min (method A)

15   2.104c. [4-(2-amino-ethyl)-phenyl]-methanol

580 mg of Raney Nickel are added to 5.8 g (39.41 mmol) of (4-hydroxymethyl-phenyl)-acetonitrile (cf. Example 1.1e.) in 116 mL methanolic NH<sub>3</sub> solution and the reaction mixture is hydrogenated at 50 psi H<sub>2</sub>. After the end of the reaction the catalyst is filtered off, the solvent is removed and the residue is purified by

20   chromatography (silica gel, EtOAc/MeOH/NH<sub>3</sub> 7:3:0.3)

Yield: 3.9 g (65.4 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 152      fnd.: molar peak (M+H)<sup>+</sup>: 152

R<sub>f</sub> value: 0.18 (silica gel, EtOAc/MeOH/NH<sub>3</sub> 8:2:0.2).

25

2.104d. tert.butyl [2-(4-hydroxymethyl-phenyl)-ethyl]-carbaminate

17.36 mL of 1M BOC anhydride in CH<sub>2</sub>Cl<sub>2</sub> are added at RT to a solution of 2.5 g

(16.53 mmol) of [4-(2-amino-ethyl)-phenyl]-methanol in 50 mL CH<sub>2</sub>Cl<sub>2</sub> and the

reaction mixture is stirred overnight at RT. 100 mL of KHSO<sub>4</sub> solution are added,

30   the organic phase is separated off, washed with dilute NaHCO<sub>3</sub> solution and water

and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the desired product is obtained.

Yield: 4.06 g (97.7 % of theory)

C<sub>14</sub>H<sub>21</sub>NO<sub>3</sub> (M= 251.33)

5 calc.: molar peak (M+H)<sup>+</sup>: 252      fnd.: molar peak (M+H)<sup>+</sup>: 252

Retention time HPLC: 6.4 min (method A)

2.104e. tert.butyl [2-(4-chloromethyl-phenyl)-ethyl]-carbaminate

1 mL pyridine is added to a solution of 2.6 g (10.35 mmol) of tert.butyl [2-(4-hydroxymethyl-phenyl)-ethyl]-carbaminate in 50 mL CH<sub>2</sub>Cl<sub>2</sub>, cooled to 0°C and 1.03 mL (12.41 mmol) of thionyl chloride are added. The mixture is kept for 1 h at 0°C and then allowed to heat up to RT. The reaction mixture is washed with water, dilute KHSO<sub>4</sub> solution and again with water, dried with MgSO<sub>4</sub> and filtered through activated charcoal. After elimination of the solvent the product is obtained as an oil, which is reacted without further purification.

Yield: 1.8 g (64.5 % of theory)

C<sub>14</sub>H<sub>20</sub>CINO<sub>2</sub> (M= 269.77)

calc.: molar peak (M-H)<sup>-</sup>: 268/270      fnd.: molar peak (M-H)<sup>-</sup>: 268/270

R<sub>f</sub> value: 0.62 (silica gel, petroleum ether/EtOAc 7:3).

20  
2.104f. tert-butyl {2-[4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-carbaminate  
2.37 g (17.13 mmol) of K<sub>2</sub>CO<sub>3</sub> and 0.8 mL (10.38 mmol) of 2,5-dihydro-1H-pyrrole are added to a solution of 1.4 g (5.19 mmol) of tert.butyl [2-(4-chloromethyl-phenyl)-ethyl]-carbaminate in 50 mL acetonitrile and the mixture is stirred overnight at RT. The reaction mixture is diluted with CH<sub>2</sub>Cl<sub>2</sub>, washed with water and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the desired product is obtained.

Yield: 1.46 g (93.0 % of theory)

C<sub>18</sub>H<sub>26</sub>N<sub>2</sub>O<sub>2</sub> (M= 302.42)

30 calc.: molar peak (M+H)<sup>+</sup>: 303      fnd.: molar peak (M+H)<sup>+</sup>: 303

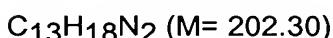
R<sub>f</sub> value: 0.15 (silica gel, petroleum ether/EtOAc 7:3).

2.104g. 2-[4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethylamine

5 mL trifluoroacetic acid are added to a solution of 1.21 g (4 mmol) of tert.butyl {2-

- 5 [4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-carbaminate in 50 mL CH<sub>2</sub>Cl<sub>2</sub> and stirred for 2 h at RT. The reaction mixture is evaporated down in vacuo, the residue combined with water and CH<sub>2</sub>Cl<sub>2</sub> and made alkaline with K<sub>2</sub>CO<sub>3</sub> solution. The organic phase is separated off, washed with water and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the desired product is obtained.

10 Yield: 0.35 g (43.3 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 203      fnd.: molar peak (M+H)<sup>+</sup>: 203

R<sub>f</sub> value: 0.05 (silica gel, EtOAc/MeOH/NH<sub>3</sub> 9:1:0.1).

15 2.104h. 4'-bromo-biphenyl-4-carboxylic acid-{2-[4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-amide

Prepared according to general working method I from 139 mg (0.50 mmol) of 4'-bromo-biphenyl-4-carboxylic acid and 101 mg (0.50 mmol) of 2-[4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethylamine.

20 Yield: 21 mg (9.1 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 461/463      fnd.: molar peak (M+H)<sup>+</sup>: 461/463

Retention time HPLC: 6.46 min (method A)

**Example 2.105:**

4'-chloro-biphenyl-4-carboxylic acid {2-[4-(1-ethyl-piperidin-2-yl)-phenyl]-ethyl}-amide



- 5 2.105a. (4-pyridin-2-yl-phenyl)-acetonitrile

Prepared analogously to Example 2.46b from 0.52 mL (5.40 mmol) of 2-bromo-pyridine and 1.0 g (5.96 mmol) of 4-cyanomethylphenyl-boric acid. After elimination of the drying agent and solvent the residue is triturated with diisopropylether and dried in the air.

- 10 Yield: 0.76 g (72.5 % of theory)

C<sub>13</sub>H<sub>10</sub>N<sub>2</sub> (M= 194.24)

calc.: molar peak (M+H)<sup>+</sup>: 195      fnd.: molar peak (M+H)<sup>+</sup>: 195

Retention time HPLC: 3.56 min (method B)

- 15 2.105b. 2-(4-cyanomethyl-phenyl)-1-ethyl-pyridinium iodide

0.38 mL (4.7 mmol) of ethyl iodide are added to a solution of 760 mg (3.91 mmol) of (4-pyridin-2-yl-phenyl)-acetonitrile in 5 mL DMF and stirred overnight at RT. To complete the reaction the solution is treated for 20 min at 120°C in the microwave. The solvent is evaporated down in vacuo, the residue is combined with water and extracted with EtOAc. The aqueous phase is evaporated down, the residue trituated with THF and the suspension cooled to 0°C . The product is suction filtered and dried at 50°C.

Yield: 800 mg (58.4 % of theory)

C<sub>15</sub>H<sub>15</sub>IN<sub>2</sub> (M= 350.21)

- 25 calc.: molar peak (M)<sup>+</sup>: 223      fnd.: molar peak (M)<sup>+</sup>: 223

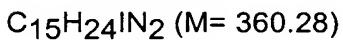
Retention time HPLC: 1.76 min (method A)

2.105c. 2-[4-(1-ethyl-piperidin-2-yl)-phenyl]-ethylamine

100 mg of Raney nickel are added to a solution of 800 mg (2.28 mmol) of 2-(4-cyanomethyl-phenyl)-1-ethyl-pyridinium iodide in 10 mL methanolic NH<sub>3</sub> and the

5 reaction mixture is hydrogenated at 20 psi and RT 24 h in the autoclave. The catalyst is suction filtered, the reaction solution is combined with 100 mg PtO<sub>2</sub> and hydrogenated again at RT and 20 psi 30 h. After elimination of the catalyst the product is obtained (as the hydroiodide), which is reacted further without purification.

10 Yield: 700 mg (85.1 % of theory)



calc.: molar peak (M)<sup>+</sup>: 233      fnd.: molar peak (M)<sup>+</sup>: 233

Retention time HPLC: 0.93 min (isocratic water:acetonitrile:formic acid 95:5:0.01 over 8 min).

15

2.105d. 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(1-ethyl-piperidin-2-yl)-phenyl]-ethyl}-amide

Prepared according to general working method I from 480 mg (1.33 mmol) of 2-[4-(1-ethyl-piperidin-2-yl)-phenyl]-ethylamine (used as the hydroiodide) and 310 mg

20 (1.33 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 20 mg (3.4 % of theory)

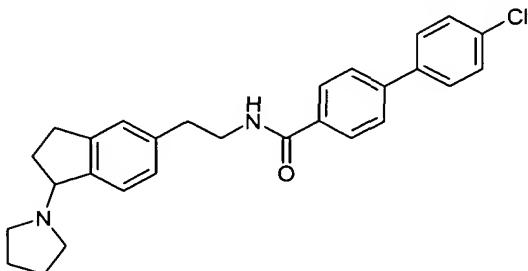


calc.: molar peak (M+H)<sup>+</sup>: 447/449      fnd.: molar peak (M+H)<sup>+</sup>: 447/449

Retention time HPLC: 6.68 min (method A)

**Example 2.106:**

4'-chloro-biphenyl-4-carboxylic acid [2-(1-pyrrolidin-1-yl-indan-5-yl)-ethyl]-amide



5

2.106a. ethyl (E)-3-(1-oxo-indan-5-yl)-acrylate

5.96 mL (55 mmol) of ethyl acrylate, 275 mg (1.21 mmol) of Pd(OAc)<sub>2</sub> and 704 mg (2.31 mmol) of tri-o-tolylphosphine are added to a solution of 4.64 g (21.99 mmol) of 5-bromo-indan-1-one in 110 mL triethylamine under N<sub>2</sub> and the reaction mixture  
10 is heated to 100°C for 4 h. The solvent is distilled off, the residue is combined with 150 mL EtOAc and 100 mL ice water, acidified with conc. HCl, the organic phase is washed with 100 mL water and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by chromatography (silica gel, hexane/EtOAc 9:1 towards 8:2)

15 Yield: 4.0 g (79.0 % of theory)

melting point : 100-102°C

2.106b. (E)-3-(1-oxo-indan-5-yl)-acrylic acid

20 10 mL 2 N NaOH are added to a solution of 4.0 g (17.0 mmol) of ethyl (E)-3-(1-oxo-indan-5-yl)-acrylate in 50 mL MeOH and the reaction mixture is refluxed for 30 min. Then it is combined with 11 mL 2 N HCl solution, MeOH is distilled off, the crystals are suction filtered and dried.

Yield: 3.0 g (87.3 % of theory)

melting point : 240-244°C

25

2.106c. 3-(1-oxo-indan-5-yl)-propionic acid

150 mg 10% Pd/C are added to a solution of 1.6 g (7.91 mmol) of (E)-3-(1-oxo-indan-5-yl)-acrylic acid in 50 mL MeOH and the reaction mixture is shaken in a Parr autoclave at RT and 3 bar H<sub>2</sub> until the theoretical uptake of H<sub>2</sub> has been achieved. 10 mL of 1 N NaOH are added and the solvent is removed. The residue

- 5 is acidified with dilute HCl, exhaustively extracted with EtOAc and the organic phase is dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is triturated with tert.-butylmethylether, the precipitate is suction filtered and dried.

Yield: 500 mg (31.0 % of theory)

10 C<sub>12</sub>H<sub>12</sub>O<sub>3</sub> (M= 204.23)

calc.: molar peak (M-H)<sup>-</sup>: 203 fnd.: molar peak (M-H)<sup>-</sup>: 203

R<sub>f</sub> value: 0.45 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 9:1).

2.106d. tert.butyl [2-(1-oxo-indan-5-yl)-ethyl]-carbaminate

- 15 1.6 g (7.83 mmol) of 3-(1-oxo-indan-5-yl)-propionic acid are added to 25 ml tert. butanol and 2.5 mL triethylamine under an argon atmosphere. 2.22 mL (10.0 mmol) of diphenyl azido-phosphate are added to this solution and heated to 80°C for 3 h. The reaction mixture is evaporated down in vacuo and the residue is purified by chromatography on silica gel.

20 Yield: 750 mg (34.8 % of theory)

C<sub>16</sub>H<sub>21</sub>NO<sub>3</sub> (M= 275.35)

calc.: molar peak (M)<sup>+</sup>: 275 fnd.: molar peak (M)<sup>+</sup>: 275

R<sub>f</sub> value: 0.65 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 95:5).

25 2.106e. tert.butyl [2-(1-hydroxy-indan-5-yl)-ethyl]-carbaminate

700 mg (18.5 mmol) of NaBH<sub>4</sub> are added batchwise to a solution of 700 mg (2.54 mmol) of tert.butyl [2-(1-oxo-indan-5-yl)-ethyl]-carbaminate in 70 mL MeOH and stirred overnight at RT. The reaction solution is carefully combined with 10% KHSO<sub>4</sub> solution, diluted with water and exhaustively extracted with tert.-

30 butylmethyl-ether. The organic phase is washed with water and dried over MgSO<sub>4</sub>.

After elimination of the drying agent and solvent the residue is purified by chromatography on silica gel.

Yield: 350 mg (49.7 % of theory)

C<sub>16</sub>H<sub>23</sub>NO<sub>3</sub> (M= 277.37)

5 calc.: molar peak (M)<sup>+</sup>: 277 fnd.: molar peak (M)<sup>+</sup>: 277

R<sub>f</sub> value: 0.30 (silica gel, petroleum ether/EtOAc 6:4).

2.106f. [2-(1-pyrrolidin-1-yl-indan-5-yl)-ethyl]-carbaminate tert.butyl

109  $\mu$ L (1.5 mmol) of thionyl chloride (dissolved in a little CH<sub>2</sub>Cl<sub>2</sub>) are slowly added dropwise to a solution of 350 mg (1.26 mmol) of tert.butyl [2-(1-hydroxy-indan-5-yl)-ethyl]-carbaminate in 7.5 mL CH<sub>2</sub>Cl<sub>2</sub> cooled to 0°C. Stirring is continued for a further 30 min at 10°C, the reaction solution is combined with ice-cold NaHCO<sub>3</sub> solution, the organic phase is separated off, washed with cold water and dried over MgSO<sub>4</sub>. After elimination of the drying agent the filtrate is cooled to 0°C , 417 15  $\mu$ L (5.0 mmol) of pyrrolidine are added dropwise and the reaction mixture is stirred overnight at RT. The reaction mixture is evaporated down and the residue is purified by chromatography on silica gel.

Yield: 120 mg (28.8 % of theory)

C<sub>20</sub>H<sub>30</sub>N<sub>2</sub>O<sub>2</sub> (M= 330.47)

20 calc.: molar peak (M+H)<sup>+</sup>: 331 fnd.: molar peak (M+H)<sup>+</sup>: 331

Retention time HPLC: 5.6 min (method A)

2.106g. 2-(1-pyrrolidin-1-yl-indan-5-yl)-ethylamine

100  $\mu$ L trifluoroacetic acid are added with gentle cooling to a solution of 100 mg (0.3 mmol) of tert.butyl [2-(1-pyrrolidin-1-yl-indan-5-yl)-ethyl]-carbaminate in 10 25 mL CH<sub>2</sub>Cl<sub>2</sub> and stirred for 1 h at RT. To complete the reaction a further 500  $\mu$ L of trifluoroacetic acid are added with cooling and the mixture is stirred for 2 h at RT. The reaction mixture is evaporated down in vacuo and the product (as the bis-trifluoroacetate) is further reacted without purification.

30 Yield: 100 mg (72.7 % of theory)

C<sub>19</sub>H<sub>24</sub>F<sub>6</sub>N<sub>2</sub>O<sub>4</sub> (M= 458.51)

calc.: molar peak (M+H)<sup>+</sup>: 231      fnd.: molar peak (M+H)<sup>+</sup>: 231

R<sub>f</sub> value: 0.3 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

- 5 2.106h. 4'-chloro-biphenyl-4-carboxylic acid [2-(1-pyrrolidin-1-yl-indan-5-yl)-ethyl]-amide

Prepared according to general working method I from 100 mg (0.29 mmol) of 2-(1-pyrrolidin-1-yl-indan-5-yl)-ethylamine (used as the bis-trifluoroacetate) and 70 mg (0.3 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

- 10 Yield: 40 mg (30.0 % of theory)

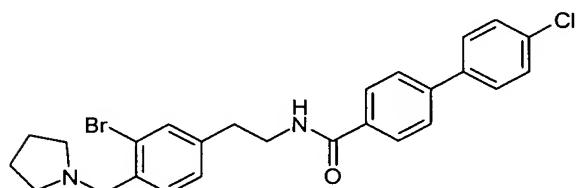
C<sub>28</sub>H<sub>29</sub>CIN<sub>2</sub>O (M= 445.01)

calc.: molar peak (M+H)<sup>+</sup>: 445/447      fnd.: molar peak (M+H)<sup>+</sup>: 445/447

Retention time HPLC: 6.65 min (method A)

- 15 **Example 2.107:**

4'-chloro-biphenyl-4-carboxylic acid [2-(3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



- 20 2.107a. methyl 2-bromo-4-cyanomethyl-benzoate

A solution of 98.55 g (0.32 mol) of methyl 2-bromo-4-bromomethyl-benzoate in 60 mL EtOH is added to a solution of 24.51 g (0.5 mol) of NaCN in 40 mL water and the reaction mixture is refluxed for 5 h. 1 L of tert.-butylmethylether and 500 mL water are added, the organic phase is separated off, washed several times with

- 25 water and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by chromatography on silica gel (petroleum ether /EtOAc 8:2).

Yield: 15.0 g (16.6 % of theory)



calc.: molar peak ( $M-H^-$ ): 252/254

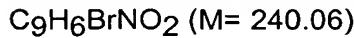
fdn.: molar peak ( $M-H^-$ ): 252/254

5    2.107b. 2-bromo-4-cyanomethyl-benzoic acid

35 mL 1M NaOH solution are added to a solution of 7.9 g (31.0 mmol) of methyl 2-bromo-4-cyanomethyl-benzoate in 100 mL EtOH, the reaction mixture is refluxed for 1 h and then stirred overnight at RT. Ice water is added and the mixture is acidified with dilute  $KHSO_4$  solution. The precipitate is suction filtered, washed with

10    water and dried at 50°C.

Yield: 6.2 g (83.3 % of theory)



calc.: molar peak ( $M-H^-$ ): 238/240              fnd.: molar peak ( $M-H^-$ ): 238/240

Retention time HPLC: 3.99 min (method B)

15

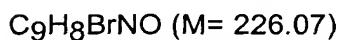
2.107c. (3-bromo-4-hydroxymethyl-phenyl)-acetonitrile

1.78 g (11 mmol) of CDI are added to a solution of 2.4 g (10 mmol) of 2-bromo-4-cyanomethyl-benzoic acid in 50 mL THF and the water bath is heated until the development of gas has ceased. Then this is added to a solution of 0.76 g (20

20    mmol) of  $NaBH_4$  in 50 mL water, while the temperature should not exceed 30°C.

Stirring is continued for a further 2 h at RT, the reaction mixture is carefully acidified with dilute  $KHSO_4$  solution, extracted exhaustively with tert.-butylmethylether, the organic phase is washed with water and dried over  $MgSO_4$ . It is filtered through activated charcoal and the solvent is removed in vacuo.

25    Yield: 2.2 g (97.3 % of theory)



calc.: molar peak ( $M-H^-$ ): 224/226              fnd.: molar peak ( $M-H^-$ ): 224/226

$R_f$  value: 0.6 (silica gel,  $CH_2Cl_2/MeOH$  9:1).

30    2.107d. (3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile

1.25 mL (9 mmol) of triethylamine are added to a solution of 1.9 g (8.4 mmol) of (3-bromo-4-hydroxymethyl-phenyl)-acetonitrile in 50 mL CH<sub>2</sub>Cl<sub>2</sub>, cooled to 0°C and a solution of 0.66 mL (8.5 mmol) of methanesulphonic acid chloride in 10 mL CH<sub>2</sub>Cl<sub>2</sub> is added dropwise. The mixture is stirred for 1 h at 0°C and then a solution  
5 of 1.4 mL (17 mmol) of pyrrolidine in 10 mL CH<sub>2</sub>Cl<sub>2</sub> is added dropwise while cooling with ice. The reaction mixture is heated overnight to RT, combined with water, the organic phase is separated off, washed twice with water, filtered through activated charcoal and evaporated down in vacuo. The residue is co-evaporated twice with toluene and the product obtained is further reacted without  
10 purification.

Yield: 2.25 g (95.9 % of theory)

C<sub>13</sub>H<sub>15</sub>BrN<sub>2</sub> (M= 279.18)

calc.: molar peak (M+H)<sup>+</sup>: 279/281      fnd.: molar peak (M+H)<sup>+</sup>: 279/281

R<sub>f</sub> value: 0.5 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

15  
2.107e. 2-(3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine  
20 mg of Raney nickel are added to a solution of 225 mg (0.81 mmol) of (3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile in 5 mL methanolic NH<sub>3</sub> and 5 mL EtOAc and shaken in a Parr autoclave for 1 h at RT and 5 psi H<sub>2</sub>. The catalyst is  
20 filtered off, the solvent evaporated down in vacuo and the product further reacted without purification.

Yield: 225 mg (98.1 % of theory)

C<sub>13</sub>H<sub>19</sub>BrN<sub>2</sub> (M= 283.21)

calc.: molar peak (M+H)<sup>+</sup>: 283/285      fnd.: molar peak (M+H)<sup>+</sup>: 283/285

25 R<sub>f</sub> value: 0.08 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

2.107f. 4'-chloro-biphenyl-4-carboxylic acid [2-(3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide hydrochloride

Prepared according to general working method I from 220 mg (0.78 mmol) of 2-(3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 186 mg (0.8 mmol) of 4'-

chloro-biphenyl-4-carboxylic acid. After elimination of the drying agent and solvent the residue is taken up in isopropanol/ tert.-butylmethylether, combined with ethereal HCl and evaporated down in vacuo. The residue is again taken up in 20 mL isopropanol, triturated, suction filtered, washed with a little isopropanol and

5 dried at 50°C.

Yield: 165 mg (39.6 % of theory)

C<sub>26</sub>H<sub>27</sub>BrCl<sub>2</sub>N<sub>2</sub>O (M= 534.33)

calc.: molar peak (M+H)<sup>+</sup>: 497/499/501

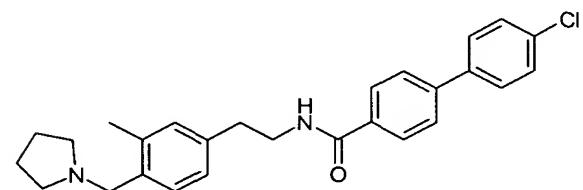
fnd.: molar peak (M+H)<sup>+</sup>:

497/499/501

10 R<sub>f</sub> value: 0.35 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

**Example 2.108:**

4'-chloro-biphenyl-4-carboxylic acid [2-(3-methyl-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



15

17.3 mg (0.28 mmol) of methylboric acid, 2.5 mL 2M Na<sub>2</sub>CO<sub>3</sub> solution and 32 mg (0.03mmol) of tetrakis-(triphenylphosphine)-palladium are added to a suspension of 150 mg (0.28 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide hydrochloride in 5 mL dioxane and the reaction mixture is refluxed for 5 h. The hot suspension is suction filtered through a glass fibre filter, the filtrate is combined with semisaturated NaHCO<sub>3</sub> solution, exhaustively extracted with EtOAc and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by chromatography on silica gel (CH<sub>2</sub>Cl<sub>2</sub>/MeOH 8:2).

20

25

Yield: 20 mg (16.4 % of theory)

C<sub>27</sub>H<sub>29</sub>ClN<sub>2</sub>O (M= 433.0)

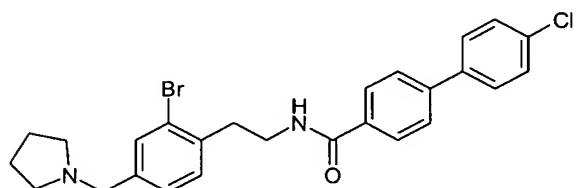
calc.: molar peak (M+H)<sup>+</sup>: 433/435

fnd.: molar peak (M+H)<sup>+</sup>: 433/435

Retention time HPLC: 6.47 min (method A)

**Example 2.109:**

4'-chloro-biphenyl-4-carboxylic acid [2-(2-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-5-ethyl]-amide



2.109a. ethyl 4-(2-amino-ethyl)-3-nitro-benzoate

5.78 g (57 mmol) of  $\text{KNO}_3$  are added batchwise to a solution of 12.0 g (52 mmol)  
10 of ethyl 4-(2-amino-ethyl)-benzoate in 80 mL conc.  $\text{H}_2\text{SO}_4$  cooled to -5°C and  
stirred for 1 h at this temperature. The reaction solution is slowly added dropwise  
to ice water (the temperature should not exceed 0°C) and stirred for 1 h. The  
precipitate is suction filtered, washed with water and dried at 50°C.

Yield: 8.2 g (66.2 % of theory)

15  $\text{C}_{11}\text{H}_{14}\text{N}_2\text{O}_4$  ( $M= 238.25$ )

calc.: molar peak  $(\text{M}+\text{H})^+$ : 239      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 239

Retention time HPLC: 3.64 min (method A)

2.109b. ethyl 4-{2-[ $(4'$ -chloro-biphenyl-4-carbonyl)-amino]-ethyl}-3-nitro-benzoate

20 Prepared according to general working method I from 8.2 g (34 mmol) of ethyl 4-(2-amino-ethyl)-3-nitro-benzoate and 7.91 g (34 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 7.7 g (50.0 % of theory)

$\text{C}_{24}\text{H}_{21}\text{ClN}_2\text{O}_5$  ( $M= 452.90$ )

25 calc.: molar peak  $(\text{M}+\text{H})^+$ : 452/454      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 452/454

Retention time HPLC: 6.14 min (method B)

2.109c. ethyl 3-amino-4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoate

0.5 g of Raney Nickel are added to a solution of 7.7 g (17 mmol) of ethyl 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-3-nitro-benzoate in 200 mL EtOAc and the reaction mixture is shaken overnight in the autoclave at RT and 10 psi H<sub>2</sub>. To

- 5 complete the reaction 50 mL THF are added and the mixture is shaken for a further 2 h. The catalyst is suction filtered, washed thoroughly with THF, the solvent is evaporated down in vacuo, the residue is triturated with EtOAc, suction filtered again and dried in the air.

Yield: 5.0 g (69.5 % of theory)

10 C<sub>24</sub>H<sub>23</sub>CIN<sub>2</sub>O<sub>3</sub> (M= 422.92)

calc.: molar peak (M+H)<sup>+</sup>: 423/425      fnd.: molar peak (M+H)<sup>+</sup>: 423/425

Retention time HPLC: 5.71 min (method B)

2.109d. ethyl 3-bromo-4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoate

- 15 20 mL 48% HBr are added to a solution of 5.0 g (7.69 mmol) of ethyl 3-amino-4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoate in 20 mL water and cooled to 0°C . Then a solution of 0.9 g (13 mmol) of NaNO<sub>2</sub> in 5.2 mL water is added dropwise so that the temperature does not exceed 5°C and the mixture is stirred for a further 10 min at 0°C. Then a solution of 1.87 g (13 mmol) of CuBr in  
20 6.65 mL 48% HBr is immediately added dropwise at this temperature. The reaction mixture is then heated to 60°C for 1 h. Water is added and the mixture is extracted exhaustively with EtOAc. The organic phase is washed with water and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by chromatography on silica gel (petroleum ether/EtOAc 6:4).

25 Yield: 1.3 g (34.7 % of theory)

C<sub>24</sub>H<sub>21</sub>BrCINO<sub>3</sub> (M= 486.80)

calc.: molar peak (M+H)<sup>+</sup>: 486/488/490      fnd.: molar peak (M+H)<sup>+</sup>:  
486/488/490

R<sub>f</sub> value: 0.55 (silica gel, petroleum ether/EtOAc 6:4).

30

- 2.109e. 3-bromo-4-{2-[{(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoic acid  
6 mL 1N NaOH solution are added to a suspension of 1.3 g (2.67 mmol) of ethyl 3-  
bromo-4-{2-[{(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoate in 20 mL  
EtOH and 5 mL THF and the reaction mixture is stirred overnight at RT. It is  
5 evaporated down in vacuo, the residue is combined with water and neutralised  
with 1 N HCl, whereupon the product is precipitated. Stirring is continued for  
another hour while cooling with ice, the mixture is suction filtered, washed with  
water and the product is dried at 50°C.  
Yield: 1.2 g (97.9 % of theory)
- 10 C<sub>22</sub>H<sub>17</sub>BrCINO<sub>3</sub> (M= 458.74)  
calc.: molar peak (M+H)<sup>+</sup>: 456/458/460      fnd.: molar peak (M+H)<sup>+</sup>:  
456/458/460  
Retention time HPLC: 5.51 min (method B)
- 15 2.109f. 4'-chloro-biphenyl-4-carboxylic acid [2-(2-bromo-4-hydroxymethyl-phenyl)-  
ethyl]-amide  
0.64 g (3.92 mmol) of CDI are added to a solution of 1.2 g (2.62 mmol) of 3-  
bromo-4-{2-[{(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoic acid in 10 mL  
DMF and the mixture is heated to 50°C until the development of gas has ceased.  
20 The reaction mixture is added to a solution of 0.3 g (7.85 mmol) of NaBH<sub>4</sub> in 10  
mL water, stirred for 1 h at RT, acidified with dilute KHSO<sub>4</sub> solution and  
exhaustively extracted with EtOAc. The organic phase is washed with  
semisaturated NaHCO<sub>3</sub> solution and dried over MgSO<sub>4</sub>. After elimination of the  
drying agent and solvent the residue is further reacted without purification.  
25 Yield: 0.87 g (74.8 % of theory)  
C<sub>22</sub>H<sub>19</sub>BrCINO<sub>2</sub> (M= 444.76)  
calc.: molar peak (M+H)<sup>+</sup>: 444/446/448      fnd.: molar peak (M+H)<sup>+</sup>:  
444/446/448  
Retention time HPLC: 8.07 min (method A)

2.109g. 4'-chloro-biphenyl-4-carboxylic acid [2-(2-bromo-4-chlormethyl-phenyl)-ethyl]-amide

0.24 mL (2.93 mmol) of pyridine are added to a solution of 0.87 g (1.96 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(2-bromo-4-hydroxymethyl-phenyl)-ethyl]-

5 amide in 20 mL  $\text{CH}_2\text{Cl}_2$  and cooled to 0°C . 0.21 mL (2.93 mmol) of thionyl chloride is added, the mixture is stirred for 1 h at this temperature and then allowed to warm up to RT. Water is added, the mixture is filtered through Celite, the aqueous phase is extracted with  $\text{CH}_2\text{Cl}_2$  and the combined organic phases are dried over  $\text{MgSO}_4$ . After elimination of the drying agent and solvent the residue is

10 further reacted without purification.

Yield: 0.66 g (72.8 % of theory)

$\text{C}_{22}\text{H}_{18}\text{BrCl}_2\text{NO}$  ( $M= 463.21$ )

calc.: molar peak ( $\text{M}+\text{H})^+$ : 462/464/466      fnd.: molar peak ( $\text{M}+\text{H})^+$ :  
462/464/466

15 Retention time HPLC: 6.37 min (method B)

2.109h. 4'-chloro-biphenyl-4-carboxylic acid [2-(2-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

0.59 g ( 4.28 mmol) of  $\text{K}_2\text{CO}_3$  and 0.24 mL (2.85 mmol) of pyrrolidine are added to  
20 a solution of 0.66 g (1.43 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(2-bromo-4-chloromethyl-phenyl)-ethyl]-amide in 20 mL acetonitrile and 6 mL DMF and stirred for 5 h at RT. Water is added, the mixture is extracted exhaustively with EtOAc, the organic phase is washed several times with water and dried over  $\text{MgSO}_4$ . After elimination of the drying agent and solvent the residue is purified by  
25 chromatography on silica gel ( $\text{CH}_2\text{Cl}_2/\text{MeOH}$  9:1).

Yield: 0.2 g (28.2 % of theory)

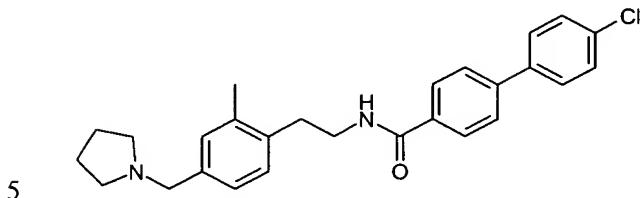
$\text{C}_{26}\text{H}_{26}\text{BrClN}_2\text{O}$  ( $M= 497.87$ )

calc.: molar peak ( $\text{M}+\text{H})^+$ : 497/499/501      fnd.: molar peak ( $\text{M}+\text{H})^+$ :  
497/499/501

30 Retention time HPLC: 4.39 min (method B)

**Example 2.110:**

4'-chloro-biphenyl-4-carboxylic acid [2-(2-methyl-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



Prepared analogously to Example 2.108 from 200 mg (0.40 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(2-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide and 27.3 mg (0.44 mmol) of methylboric acid, by refluxing for only 2 h and  
10 purifying the product by HPLC.

Yield: 62 mg (35.6 % of theory)

C<sub>27</sub>H<sub>29</sub>ClN<sub>2</sub>O (M= 433.0)

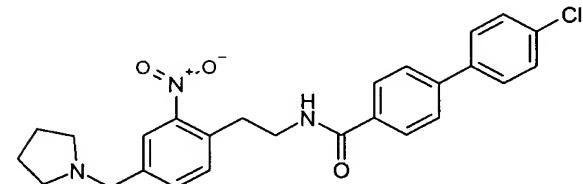
calc.: molar peak (M+H)<sup>+</sup>: 433/435      fdn.: molar peak (M+H)<sup>+</sup>: 433/435

Retention time HPLC: 6.15 min (method A)

15

**Example 2.111:**

4'-chloro-biphenyl-4-carboxylic acid [2-(2-nitro-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



20

2.111a. 4-{2-[4'-chloro-biphenyl-4-carbonyl]-amino}-ethyl]-3-nitro-benzoic acid

2 mL 1N NaOH solution are added to a solution of 200 mg (0.44 mmol) of ethyl 4-{2-[4'-chloro-biphenyl-4-carbonyl]-amino}-ethyl]-3-nitro-benzoate (Example 2.109b) in 10 mL EtOH and the reaction mixture is stirred for 1 h at RT. The

mixture is evaporated down in vacuo, water and 2 mL 1N HCl solution are added to the residue and the suspension is stirred for 30 min in the ice bath. The product is suction filtered, washed with water and dried at 50°C.

Yield: 180 mg (95.9 % of theory)

5 C<sub>22</sub>H<sub>17</sub>CIN<sub>2</sub>O<sub>5</sub> (M= 424.84)

calc.: molar peak (M+H)<sup>+</sup>: 425/427 fnd.: molar peak (M+H)<sup>+</sup>: 425/427

R<sub>f</sub> value: 0.07 (silica gel, EtOAc/MeOH/NH<sub>3</sub> 9:1:0.1).

2.111b. 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-hydroxymethyl-2-nitro-phenyl)-ethyl]-amide

Prepared analogously to Example 2.109f from 180 mg (0.42 mmol) of 4-{2-[4'-chloro-biphenyl-4-carbonyl]-amino}-ethyl}-3-nitro-benzoic acid.

Yield: 110 mg (63.1 % of theory)

C<sub>22</sub>H<sub>19</sub>CIN<sub>2</sub>O<sub>4</sub> (M= 410.86)

15 calc.: molar peak (M+H)<sup>+</sup>: 411/413 fnd.: molar peak (M+H)<sup>+</sup>: 411/413

Retention time HPLC: 8.27 min (method A)

2.111c. 4'-chloro-biphenyl-4-carboxylic acid [2-(2-nitro-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

20 23  $\mu$ L methanesulphonic acid chloride are slowly added dropwise to a solution of 110 mg (0.27 mmol) of 4'-chloro-biphenyl-4-carboxylic acid-[2-(4-hydroxymethyl-2-nitro-phenyl)-ethyl]-amide and 48  $\mu$ L triethylamine in 5 mL CH<sub>2</sub>Cl<sub>2</sub> cooled to 5°C. The solution is heated for 1 h to 40°C, 5 mL DMF and 115  $\mu$ L (1.34 mmol) of pyrrolidine are added and the mixture is heated to 80°C for a further hour, during 25 which time the CH<sub>2</sub>Cl<sub>2</sub> is evaporated off. The reaction mixture is evaporated down in vacuo, the residue is combined with water, exhaustively extracted with EtOAc and the organic phase is dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by HPLC.

Yield: 11 mg (8.8 % of theory)

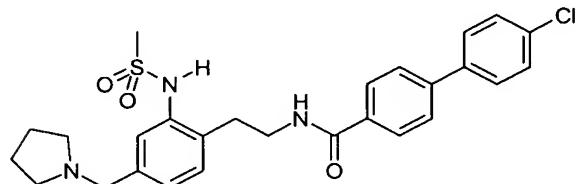
30 C<sub>26</sub>H<sub>26</sub>CIN<sub>3</sub>O<sub>3</sub> (M= 463.97)

calc.: molar peak ( $M+H$ ) $^+$ : 464/466      fnd.: molar peak ( $M+H$ ) $^+$ : 464/466

Retention time HPLC: 6.44 min (method A)

**Example 2.112:**

- 5 4'-chloro-biphenyl-4-carboxylic acid [2-(2-methanesulphonylamino-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.112a. ethyl 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-3-methanesulphonylamino-benzoate

- 10 44  $\mu$ L (0.57 mmol) of methanesulphonic acid chloride are slowly added dropwise to a solution of 200 mg (0.47 mmol) of ethyl 3-amino-4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-benzoate (Example 2.109c) in 5 mL pyridine cooled to 0°C and the reaction mixture is stirred for 1 h at RT. It is combined with ice water, extracted exhaustively with EtOAc, the organic phase is washed several times with water and dried over  $MgSO_4$ . After elimination of the drying agent and solvent the residue is further reacted without purification.
- 15 Yield: 230 mg (97.1 % of theory)

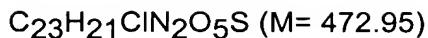
$C_{25}H_{25}ClN_2O_5S$  ( $M= 501.01$ )

calc.: molar peak ( $M+H$ ) $^+$ : 501/503      fnd.: molar peak ( $M+H$ ) $^+$ : 501/503

- 20 Retention time HPLC: 5.66 min (method B)

2.112b. 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-3-methanesulphonylamino-benzoic acid

- Prepared analogously to Example 2.111a from 230 mg (0.46 mmol) of ethyl 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-3-methanesulphonylamino-benzoate.
- 25 Yield: 180 mg (82.9 % of theory)



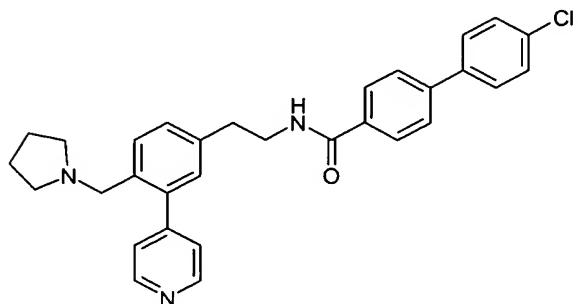
calc.: molar peak ( $M-H^-$ ): 471/473      fnd.: molar peak ( $M-H^-$ ): 471/473

Retention time HPLC: 7.67 min (method A)

- 5    2.112c. 4'-chloro-biphenyl-4-carboxylic acid [2-(4-hydroxymethyl-2-methanesulphonylamino-phenyl)-ethyl]-amide  
Prepared analogously to Example 2.109f from 180 mg (0.38 mmol) of 4-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-3-methanesulphonylamino-benzoic acid.  
Yield: 150 mg (85.8 % of theory)
- 10     $C_{23}H_{23}ClN_2O_4S$  ( $M= 458.97$ )  
calc.: molar peak ( $M+H^+$ ): 459/461      fnd.: molar peak ( $M+H^+$ ): 459/461  
Retention time HPLC: 7.53 min (method A)
- 15    2.112d. 4'-chloro-biphenyl-4-carboxylic acid [2-(2-methanesulphonylamino-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide  
Prepared analogously to Example 2.111c from 150 mg (0.33 mmol) of 4'-chlorobiphenyl-4-carboxylic acid [2-(4-hydroxymethyl-2-methanesulphonylamino-phenyl)-ethyl]-amide and 140  $\mu$ L (1.64 mmol) of pyrrolidine.  
After purification by HPLC the product is obtained as the formate salt.  
Yield: 18 mg (9.9 % of theory)  
 $C_{27}H_{30}ClN_3O_3S^*CH_2O_2$  ( $M= 558.10$ )  
calc.: molar peak ( $M+H^+$ ): 512/514      fnd.: molar peak ( $M+H^+$ ): 512/514  
Retention time HPLC: 6.13 min (method A)

**Example 2.113:**

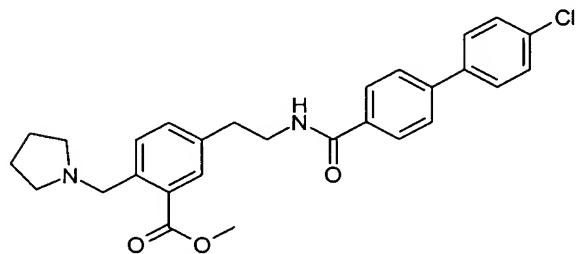
4'-chloro-biphenyl-4-carboxylic acid [2-(3-pyridin-4-yl-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



- 5 Prepared analogously to Example 2.108 from 200 mg (0.40 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide and 74 mg (0.60 mmol) of pyridine-4-boric acid, purifying the product by HPLC.  
Yield: 13 mg (6.5 % of theory)  
 $C_{31}H_{30}ClN_3O$  ( $M= 496.06$ )
- 10 calc.: molar peak  $(M+H)^+$ : 496/498      fnd.: molar peak  $(M+H)^+$ : 496/498  
Retention time HPLC: 6.37 min (method A)

**Example 2.114:**

- 15 Methyl 5-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-2-pyrrolidin-1-ylmethyl-benzoate

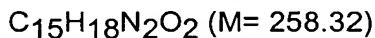


2.114a. methyl 5-cyanomethyl-2-pyrrolidin-1-ylmethyl-benzoate

- 20 0.5 mL triethylamine (3.58 mmol), 40 mg (0.18 mmol) of  $Pd(OAc)_2$  and 99 mg (0.18 mmol) of 1,1'-diphenylphosphino-ferrocene are added to a solution of 500

mg (1.79 mmol) of (3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile (Example 2.107d) in 10 mL MeOH and 10 mL DMF. The reaction mixture is stirred for 15 h at 50°C in an autoclave with 2 bar CO. To complete the reaction a further 0.5 mL triethylamine, 40 mg Pd(OAc)<sub>2</sub> and 99 mg 1,1'-diphenylphosphino-ferrocene are  
5 added, and the mixture is stirred for a further 10 h at 50°C and 2 bar CO and overnight at 4 bar CO and 70°C. The solvents are evaporated down in vacuo, the residue is combined with EtOAc and extracted twice with water. The aqueous phase is saturated with K<sub>2</sub>CO<sub>3</sub>, exhaustively extracted with EtOAc and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the product is left is a  
10 black oil which is further reacted without purification.

Yield: 380 mg (82.1 % of theory).

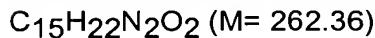


calc.: molar peak (M+H)<sup>+</sup>: 259      fnd.: molar peak (M+H)<sup>+</sup>: 259

Retention time HPLC: 2.49 min (method B)

15  
2.114b. methyl 5-(2-amino-ethyl)-2-pyrrolidin-1-ylmethyl-benzoate  
100 mg of Raney nickel are added to a solution of 380 mg (1.47 mmol) of methyl 5-cyanomethyl-2-pyrrolidin-1-ylmethyl-benzoate in 20 mL methanolic NH<sub>3</sub> and the reaction mixture is hydrogenated at 20 psi H<sub>2</sub> for 27 h at RT. The catalyst is  
20 suction filtered, the solvent is eliminated and the residue is further reacted without purification.

Yield: 330 mg (85.5 % of theory).



calc.: molar peak (M+H)<sup>+</sup>: 263      fnd.: molar peak (M+H)<sup>+</sup>: 263

25 Retention time HPLC: 1.40 min (method A)

2.114c. methyl 5-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-2-pyrrolidin-1-ylmethyl-benzoate

Prepared according to general working method I from 330 mg (1.26 mmol) of methyl 5-(2-amino-ethyl)-2-pyrrolidin-1-ylmethyl-benzoate and 293 mg (1.26 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 315 mg (52.5 % of theory)

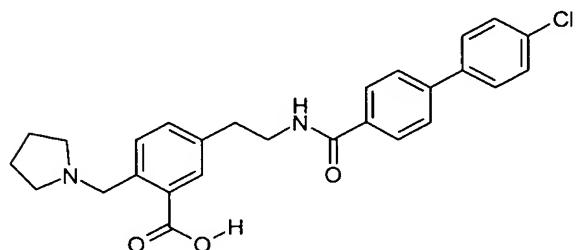
5 C<sub>28</sub>H<sub>29</sub>CIN<sub>2</sub>O<sub>3</sub> (M= 477.01)

calc.: molar peak (M+H)<sup>+</sup>: 477/479      fnd.: molar peak (M+H)<sup>+</sup>: 477/479

Retention time HPLC: 6.82 min (method A)

**Example 2.115:**

10 5-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-2-pyrrolidin-1-ylmethyl-benzoic acid



Prepared analogously to Example 2.111a from 310 mg (0.65 mmol) of methyl 5-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-2-pyrrolidin-1-ylmethyl-benzoate .

15 Yield: 85 mg (28.2 % of theory)

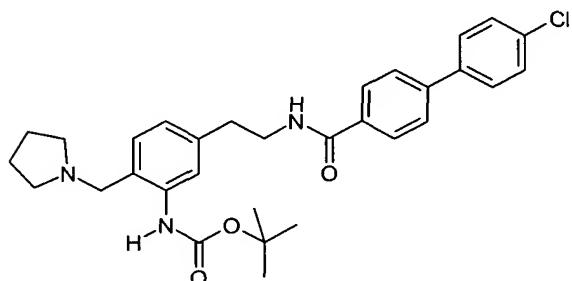
C<sub>27</sub>H<sub>27</sub>CIN<sub>2</sub>O<sub>3</sub> (M= 462.98)

calc.: molar peak (M+H)<sup>+</sup>: 463/465      fnd.: molar peak (M+H)<sup>+</sup>: 463/465

Retention time HPLC: 6.30 min (method A)

**Example 2.116:**

tert.butyl (5-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-2-pyrrolidin-1-ylmethyl-phenyl)-carbaminate



- 5 0.27 mL (1.92 mmol) of triethylamine and 0.41 mL (1.92 mmol) of diphenyl azido-phosphate are added to a solution of 740 mg (1.6 mmol) of 5-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-2-pyrrolidin-1-ylmethyl-benzoic acid in 10 mL tert. butanol and the reaction mixture is refluxed for 5 h. It is evaporated down in vacuo, the residue is combined with CH<sub>2</sub>Cl<sub>2</sub>, extracted with 1N NaOH solution and  
10 the organic phase is dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by chromatography on silica gel.

Yield: 85 mg (28.2 % of theory)

C<sub>31</sub>H<sub>36</sub>CIN<sub>3</sub>O<sub>3</sub> (M= 534.10)

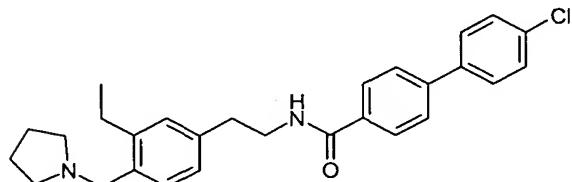
calc.: molar peak (M+H)<sup>+</sup>: 534/536      fnd.: molar peak (M+H)<sup>+</sup>: 534/536

- 15 Retention time HPLC: 4.82 min (method B)

**Example 2.117:**

4'-chloro-biphenyl-4-carboxylic acid [2-(3-ethyl-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

20



2.117a. (4-pyrrolidin-1-ylmethyl-3-trimethylsilanylethynyl-phenyl)-acetonitrile

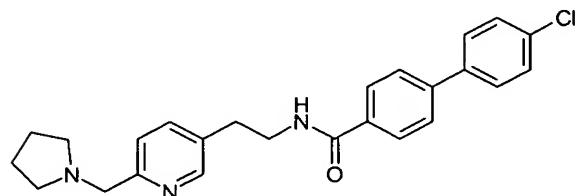
- A suspension of 0.36 g (1.29 mmol) of (3-bromo-4-pyrrolidin-1-ylmethyl-phenyl)-acetonitrile (Example 2.107d), 0.36 mL (2.58 mmol) of trimethylsilylacetylene, 0.36 mL (2.58 mmol) of triethylamine, 25 mg (0.13 mmol) of Cul and 0.15 g (0.13 mmol) of tetrakis-(triphenylphosphine)-palladium in 3 mL DMF is stirred in the microwave (CEM) for 15 min at 100°C and 200 Watt. After cooling of the reaction mixture saturated NaCl solution is added, the mixture is exhaustively extracted with EtOAc and the organic phase is dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by chromatography on silica gel (EtOAc).  
Yield: 50 mg (13.1 % of theory)
- 10 C<sub>18</sub>H<sub>24</sub>N<sub>2</sub>Si (M= 296.49)  
calc.: molar peak (M+H)<sup>+</sup>: 297      fnd.: molar peak (M+H)<sup>+</sup>: 297  
Retention time HPLC: 6.39 min (method A)
- 2.117b. 2-(3-ethyl-4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine  
15 20 mg of Raney nickel are added to a solution of 50 mg (0.17 mmol) of (4-pyrrolidin-1-ylmethyl-3-trimethylsilanylethynyl-phenyl)-acetonitrile in 5 mL methanolic NH<sub>3</sub> and the reaction mixture is shaken for 22 h at RT and 3 bar H<sub>2</sub>. The catalyst is suction filtered and the solvent is eliminated in vacuo. The crude product is further reacted without purification.  
20 Yield: 39 mg (100 % of theory)  
C<sub>15</sub>H<sub>24</sub>N<sub>2</sub> (M= 232.37)  
calc.: molar peak (M+H)<sup>+</sup>: 233      fnd.: molar peak (M+H)<sup>+</sup>: 233
- 2.117c. 4'-chloro-biphenyl-4-carboxylic acid [2-(3-ethyl-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide  
25 Prepared according to general working method I from 40 mg (0.17 mmol) of 2-(3-ethyl-4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 48 mg (0.21 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.  
Yield: 2 mg (2.6 % of theory)
- 30 C<sub>28</sub>H<sub>31</sub>ClN<sub>2</sub>O (M= 447.03)

calc.: molar peak ( $M+H$ )<sup>+</sup>: 447/449      fnd.: molar peak ( $M+H$ )<sup>+</sup>: 447/449

Retention time HPLC: 6.87 min (method A)

**Example 2.118:**

- 5 4'-chloro-biphenyl-4-carboxylic acid [2-(6-pyrrolidin-1-ylmethyl-pyridin-3-yl)-ethyl]-amide



2.118a. methyl 6-dibromomethyl-nicotinate

- 10 53.4 g (0.3 mol) of NBS and 2 g dibenzoylperoxide are added to a solution of 38.96 g (0.25 mol) of methyl 6-methyl-nicotinate in 1 L  $CCl_4$  and the reaction mixture is refluxed overnight. Then another 26.7 g (0.15 mol) of NBS and 1 g dibenzoylperoxide are added and the mixture is again refluxed for 24 h. After cooling of the reaction mixture the precipitate is suction filtered, the solvent is  
15 eliminated and the residue is purified by chromatography.

Yield: 15.0 g (19.4 % of theory)

$C_8H_7Br_2NO_2$  ( $M= 308.96$ )

calc.: molar peak ( $M+H$ )<sup>+</sup>: 308/310/312      fnd.: molar peak ( $M+H$ )<sup>+</sup>:  
308/310/312

- 20  $R_f$  value: 0.6 (silica gel, petroleum ether/EtOAc 8:2).

2.118b. methyl 6-dimethoxymethyl-nicotinate

- 13.9 mL of NaOMe in MeOH (30%, 75 mmol) in 100 mL MeOH are heated to boiling. A solution of 11.0 g (34.1 mmol) of methyl 6-dibromomethyl-nicotinate in  
25 10 mL MeOH is added dropwise to the boiling solution and refluxed overnight. To complete the reaction a further 1.5 mL (8.1 mmol) of the NaOMe solution are added and the mixture is refluxed again for 24 h. The reaction mixture is

evaporated down in vacuo, the residue is combined with dilute  $\text{KHSO}_4$  solution, neutralised with dilute  $\text{NaHCO}_3$  solution, exhaustively extracted with  $\text{EtOAc}$ , the organic phase is washed with water and dried over  $\text{MgSO}_4$ . After elimination of the drying agent and solvent the residue is further reacted without purification.

5 Yield: 5.0 g (69.5 % of theory)

$\text{C}_{10}\text{H}_{13}\text{NO}_4$  ( $M= 211.22$ )

calc.: molar peak  $(\text{M}+\text{H})^+$ : 212      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 212

$R_f$  value: 0.44 (silica gel, petroleum ether/ $\text{EtOAc}$  6:4).

10 2.118c. 6-dimethoxymethyl-nicotinic acid

15 mL 1N NaOH solution are added to a solution of 2.8 g (13.26 mmol) of methyl 6-dimethoxymethyl-nicotinate in 50 ml MeOH and stirred for 24 h at RT. The reaction mixture is neutralised with 15 mL 1N HCl, evaporated down in vacuo, the residue is triturated with MeOH/THF, the precipitate is suction filtered and the

15 filtrate is evaporated down. The product obtained is further reacted without purification.

Yield: 2.6 g (99.4 % of theory)

$\text{C}_9\text{H}_{11}\text{NO}_4$  ( $M= 197.19$ )

calc.: molar peak  $(\text{M}+\text{H})^+$ : 198      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 198

20 Retention time HPLC: 3.65 min (method A)

2.118d. (6-dimethoxymethyl-pyridin-3-yl)-methanol

Prepared analogously to Example 2.109f from 2.7 g (13.7 mmol) of 6-dimethoxymethyl-nicotinic acid, using THF as solvent and tert. butylmethylether for 25 the extraction.

Yield: 2.1 g (83.7 % of theory)

$\text{C}_9\text{H}_{13}\text{NO}_3$  ( $M= 183.21$ )

calc.: molar peak  $(\text{M}+\text{H})^+$ : 184      fnd.: molar peak  $(\text{M}+\text{H})^+$ : 184

Retention time HPLC: 2.85 min (method A)

30

2.118e. 5-chloromethyl-2-dimethoxymethyl-pyridine

0.3 mL (4.14 mmol) of thionyl chloride, dissolved in a little CH<sub>2</sub>Cl<sub>2</sub>, are slowly added dropwise to a solution of 500 mg (2.73 mmol) of (6-dimethoxymethyl-pyridin-3-yl)-methanol in 10 ml CH<sub>2</sub>Cl<sub>2</sub> cooled to 0°C and stirred for a further 30

5 min at this temperature. The reaction mixture is diluted with CH<sub>2</sub>Cl<sub>2</sub>, washed with cold NaHCO<sub>3</sub> solution and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is further reacted without purification.

Yield: 500 mg (90.8 % of theory)

C<sub>9</sub>H<sub>12</sub>ClNO<sub>2</sub> (M= 201.65)

10 calc.: molar peak (M+H)<sup>+</sup>: 202/204 fnd.: molar peak (M+H)<sup>+</sup>: 202/204

R<sub>f</sub> value: 0.3 (silica gel, petroleum ether/EtOAc 6:4).

2.118f. (6-dimethoxymethyl-pyridin-3-yl)-acetonitrile

20 mL DMSO are added to 5.21 g (80 mmol) of KCN in 5.2 mL water and at 80°C  
15 a solution of 500 mg (2.48 mmol) of 5-chloromethyl-2-dimethoxymethyl-pyridine in 10 mL DMSO is added dropwise and the reaction mixture is kept for a further hour at 80°C. It is poured onto 200 mL water, saturated with NaCl, extracted exhaustively with EtOAc, the organic phase is dried over MgSO<sub>4</sub> and filtered through activated charcoal. The filtrate is evaporated down and the residue is  
20 purified by chromatography on silica gel (CH<sub>2</sub>Cl<sub>2</sub>/MeOH 9:1).

Yield: 330 mg (69.2 % of theory)

C<sub>10</sub>H<sub>12</sub>N<sub>2</sub>O<sub>2</sub> (M= 192.22)

calc.: molar peak (M+H)<sup>+</sup>: 193 fnd.: molar peak (M+H)<sup>+</sup>: 193

R<sub>f</sub> value: 0.48 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 9:1).

25

2.118g. 2-(6-dimethoxymethyl-pyridin-3-yl)-ethylamine

50 mg of Raney nickel are added to a solution of 330 mg (1.72 mmol) of (6-dimethoxymethyl-pyridin-3-yl)-acetonitrile in 10 mL methanolic NH<sub>3</sub> and the reaction mixture is hydrogenated in a Parr autoclave at 30°C 15 h under 3 bar H<sub>2</sub>.

The catalyst is filtered off, the solvent is evaporated down in vacuo and the residue is further reacted without purification.

Yield: 340 mg (100 % of theory)

C<sub>10</sub>H<sub>16</sub>N<sub>2</sub>O<sub>2</sub> (M= 196.25)

5 calc.: molar peak (M+H)<sup>+</sup>: 197      fnd.: molar peak (M+H)<sup>+</sup>: 197

Retention time HPLC: 1.3 min (method A)

2.118h. 4'-chloro-biphenyl-4-carboxylic acid [2-(6-dimethoxymethyl-pyridin-3-yl)-ethyl]-amide

10 Prepared according to general working method I from 340 mg (1.73 mmol) of 2-(6-dimethoxymethyl-pyridin-3-yl)-ethylamine and 419 mg (1.80 mmol) of 4'-chlorobiphenyl-4-carboxylic acid.

Yield: 210 mg (28.4 % of theory)

C<sub>23</sub>H<sub>23</sub>CIN<sub>2</sub>O<sub>3</sub> (M= 410.90)

15 calc.: molar peak (M+H)<sup>+</sup>: 411/413      fnd.: molar peak (M+H)<sup>+</sup>: 411/413

R<sub>f</sub> value: 0.4 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

2.118i. 4'-chloro-biphenyl-4-carboxylic acid [2-(6-formyl-pyridin-3-yl)-ethyl]-amide

5 mL 12% HCl are added to a solution of 205 mg (0.5 mmol) of 4'-chloro-biphenyl-

20 4-carboxylic acid [2-(6-dimethoxymethyl-pyridin-3-yl)-ethyl]-amide in 10 mL MeOH and the reaction mixture is stirred for 4 h at RT and heated to 80°C overnight.

Another 2.5 mL of 12% HCl are added, the mixture is heated for a further 8 h at 80°C and overnight at 100°C. The reaction mixture is combined with 50 mL water, adjusted to pH 8 with Na<sub>2</sub>CO<sub>3</sub> solution, exhaustively extracted with CH<sub>2</sub>Cl<sub>2</sub> and the

25 organic phase is dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is further reacted without purification.

Yield: 180 mg (98.7 % of theory)

C<sub>21</sub>H<sub>17</sub>CIN<sub>2</sub>O<sub>2</sub> (M= 364.84)

calc.: molar peak (M+H)<sup>+</sup>: 365/367      fnd.: molar peak (M+H)<sup>+</sup>: 365/367

30 Retention time HPLC: 5.25 min (method A)

2.118k. 4'-chloro-biphenyl-4-carboxylic acid [2-(6-pyrrolidin-1-ylmethyl-pyridin-3-yl)-ethyl]-amide

5     50  $\mu$ L (0.6 mmol) of pyrrolidine, 37.7 mg (0.6 mmol) of NaBH<sub>3</sub>CN and 2 mL MeOH  
are added to a solution of 180 mg (0.49 mmol) of 4'-chloro-biphenyl-4-carboxylic  
acid [2-(6-formyl-pyridin-3-yl)-ethyl]-amide in 5 mL acetonitrile, the pH value is  
adjusted to 5-6 with glacial acetic acid and the mixture is stirred for 5 h at RT. The  
reaction mixture is acidified with 1M KHSO<sub>4</sub> solution, made alkaline with 2M  
Na<sub>2</sub>CO<sub>3</sub> solution, exhaustively extracted with CH<sub>2</sub>Cl<sub>2</sub> and the organic phase is  
10 dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is  
purified by chromatography on silica gel (CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

Yield: 25 mg (12.1 % of theory)

C<sub>25</sub>H<sub>26</sub>CIN<sub>3</sub>O (M= 419.96)

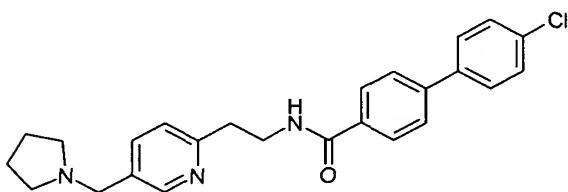
calc.: molar peak (M+H)<sup>+</sup>: 420/422                  fdn.: molar peak (M+H)<sup>+</sup>: 420/422

15 R<sub>f</sub> value: 0.2 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

**Example 2.119:**

4'-chloro-biphenyl-4-carboxylic acid [2-(5-pyrrolidin-1-ylmethyl-pyridin-2-yl)-ethyl]-amide

20



2.119a. methyl 6-hydroxymethyl-nicotinate

Prepared analogously to Example 2.109f from 5.0 g (27.6 mmol) of 5-methyl  
pyridine-2,5-dicarboxylate, using THF as solvent and tert-butylmethylether for the  
25 extraction.

Yield: 2.0 g (43.3 % of theory)

C<sub>8</sub>H<sub>9</sub>NO<sub>3</sub> (M= 167.17)

calc.: molar peak (M+H)<sup>+</sup>: 168      fnd.: molar peak (M+H)<sup>+</sup>: 168

R<sub>f</sub> value: 0.2 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 95:5).

2.119b. methyl 6-chloromethyl-nicotinate

- 5    1.06 mL (13 mmol) of pyridine added and slowly 1.08 mL (13 mmol) of thionyl chloride are added dropwise to a solution of 2.0 g (11.96 mmol) of methyl 6-hydroxymethyl-nicotinate in 100 mL CH<sub>2</sub>Cl<sub>2</sub> cooled to 0°C. This is stirred for a further hour at 0°C and then slowly heated to RT. To complete the reaction a further 1 mL (12 mmol) of thionyl chloride is added and the mixture is stirred for 1  
10 h at RT. The reaction mixture water is added, the organic phase is separated off, washed with dilute NaHCO<sub>3</sub> solution and water and dried over MgSO<sub>4</sub>. This is filtered through activated charcoal and the solvent is evaporated down in vacuo. The product obtained is further reacted without purification.

Yield: 1.7 g (65.1 % of theory)

15    C<sub>8</sub>H<sub>8</sub>CINO<sub>2</sub> (M= 185.61)

calc.: molar peak (M+H)<sup>+</sup>: 186/188      fnd.: molar peak (M+H)<sup>+</sup>: 186/188

Retention time HPLC: 6.7 min (method A)

2.119c. methyl 6-cyanomethyl-nicotinate

- 20    Prepared analogously to Example 2.118f from 1.5 g (8.08 mmol) of methyl 6-chloromethyl-nicotinate and 5.2 g (80 mmol) of KCN, using cyclohexane/EtOAc 8:2 as eluant for the purification by chromatography on silica gel.

Yield: 220 mg (15.5 % of theory)

C<sub>9</sub>H<sub>8</sub>N<sub>2</sub>O<sub>2</sub> (M= 176.18)

25    calc.: molar peak (M+H)<sup>+</sup>: 177      fnd.: molar peak (M+H)<sup>+</sup>: 177

R<sub>f</sub> value: 0.6 (silica gel, petroleum ether/EtOAc 1:1).

2.119d. methyl 6-(2-amino-ethyl)-nicotinate

- 20 mg of Raney nickel are added to a solution of 75 mg (0.43 mmol) of methyl 6-cyanomethyl-nicotinate in 5 mL methanolic NH<sub>3</sub> and the reaction mixture is  
30

hydrogenated in a Parr autoclave at 30°C for 6 h under 3 bar H<sub>2</sub>. The catalyst is filtered off, the solvent is evaporated down in vacuo and the residue is further reacted without purification.

Yield: 70 mg (90.3 % of theory)

5 C<sub>9</sub>H<sub>12</sub>N<sub>2</sub>O<sub>2</sub> (M= 180.21)

calc.: molar peak (M+H)<sup>+</sup>: 181      fnd.: molar peak (M+H)<sup>+</sup>: 181

Retention time HPLC: 2.5 min (method A)

2.119e. methyl 6-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-nicotinate

10 Prepared according to general working method I from 70 mg (0.39 mmol) of methyl 6-(2-amino-ethyl)-nicotinate and 100 mg (0.43 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 150 mg (88.3 % of theory)

C<sub>22</sub>H<sub>19</sub>CIN<sub>2</sub>O<sub>3</sub> (M= 394.86)

15 calc.: molar peak (M+H)<sup>+</sup>: 395/397      fnd.: molar peak (M+H)<sup>+</sup>: 395/397

Retention time HPLC: 8.6 min (method A)

2.119f. 6-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-nicotinic acid

0.8 mL 1 M NaOH solution are added to a solution of 150 mg (0.38 mmol) of 20 methyl 6-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-nicotinate in 25 mL MeOH and the reaction mixture is refluxed for 1 h. It is neutralised with 0.8 mL of 1 N HCl, evaporated down in vacuo, the residue is stirred with water and the precipitate is removed by suction filtering. It is dissolved in THF, the solution is dried with MgSO<sub>4</sub>, filtered and evaporated down in vacuo. The residue is further reacted without purification.

Yield: 90 mg (62.2 % of theory)

C<sub>21</sub>H<sub>17</sub>CIN<sub>2</sub>O<sub>3</sub> (M= 380.83)

calc.: molar peak (M+H)<sup>+</sup>: 381/383      fnd.: molar peak (M+H)<sup>+</sup>: 381/383

Retention time HPLC: 6.9 min (method A)

2.119g. 4'-chloro-biphenyl-4-carboxylic acid [2-(5-hydroxymethyl-pyridin-2-yl)-ethyl]-amide

Prepared analogously to Example 2.109f from 90 mg (0.24 mmol) of 6-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-nicotinic acid, using THF as solvent and

5     tert- butylmethylether for the extraction.

Yield: 50 mg (56.8 % of theory)

C<sub>21</sub>H<sub>19</sub>CIN<sub>2</sub>O<sub>2</sub> (M= 366.85)

calc.: molar peak (M+H)<sup>+</sup>: 367/369                  fnd.: molar peak (M+H)<sup>+</sup>: 367/369

R<sub>f</sub> value: 0.5 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 9:1).

10

2.119h. 4'-chloro-biphenyl-4-carboxylic acid [2-(5-pyrrolidin-1-ylmethyl-pyridin-2-yl)-ethyl]-amide

22  $\mu$ L thionyl chloride are added dropwise to a solution of 50 mg (0.14 mmol) of 4'-chloro-biphenyl-4-carboxylic acid [2-(5-hydroxymethyl-pyridin-2-yl)-ethyl]-amide in

15     5 mL CH<sub>2</sub>Cl<sub>2</sub> cooled to 0°C and the reaction mixture is slowly allowed to warm up to RT. After 1 h at RT a further 22  $\mu$ L thionyl chloride are added dropwise to complete the reaction and stirring is continued for 1 h. The reaction mixture is diluted with 30 mL CH<sub>2</sub>Cl<sub>2</sub>, combined with ice water, made alkaline with NaHCO<sub>3</sub> solution, the organic phase is separated off, washed with water and dried over

20     MgSO<sub>4</sub>. After elimination of the drying agent 50  $\mu$ L (0.6 mmol) of pyrrolidine are added to this solution and the reaction mixture is stirred overnight at RT. It is evaporated down in vacuo and the residue is purified by HPLC chromatography.

Yield: 2.4 mg (4.1 % of theory)

C<sub>25</sub>H<sub>26</sub>CIN<sub>3</sub>O (M= 419.96)

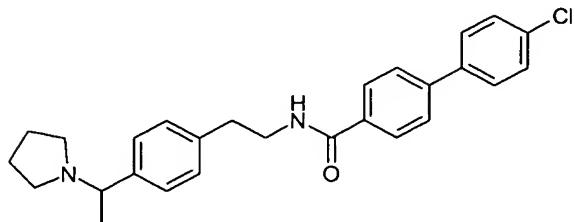
25     calc.: molar peak (M+H)<sup>+</sup>: 420/422                  fnd.: molar peak (M+H)<sup>+</sup>: 420/422

R<sub>f</sub> value: 0.3 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 9:1).

Retention time HPLC: 6.0 min (method A)

**Example 2.120:**

4'-chloro-biphenyl-4-carboxylic acid {2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethyl}-amide



5

2.120a. tert.butyl [2-(4-acetyl-phenyl)-ethyl]-carbaminate

5.46 g (25 mmol) of BOC-anhydride are added to a solution of 4.99 g (25 mmol) of 1-[4-(2-amino-ethyl)-phenyl]-ethanone (used as the hydrochloride) in 100 ml CH<sub>2</sub>Cl<sub>2</sub> and at RT 25 mL of 1N NaOH solution are slowly added dropwise and

10 after the addition has ended the mixture is stirred for 2 h at RT. The reaction mixture is filtered through Celite, washed twice with water and dried over MgSO<sub>4</sub>. It is filtered through activated charcoal, evaporated down in vacuo and the product is further reacted without purification.

Yield: 6.4 g (97.2 % of theory)

15 C<sub>15</sub>H<sub>21</sub>NO<sub>3</sub> (M= 263.34)

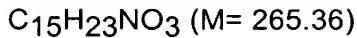
calc.: molar peak (M+H)<sup>+</sup>: 262 fnd.: molar peak (M+H)<sup>+</sup>: 262

R<sub>f</sub> value: 0.88 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

2.120b. tert.butyl {2-[4-(1-hydroxy-ethyl)-phenyl]-ethyl}-carbaminate

20 4.72 g (125 mmol) of NaBH<sub>4</sub> are added batchwise at RT to a solution of 6.58 g (25 mmol) of tert.butyl [2-(4-acetyl-phenyl)-ethyl]-carbaminate in 250 mL MeOH and the reaction mixture is stirred over the weekend. It is carefully acidified with KHSO<sub>4</sub> solution, extracted exhaustively with tert-butylmethylether, the organic phase is washed with saturated NaCl solution and dried over MgSO<sub>4</sub>. After 25 elimination of the drying agent and solvent the product is left as a slightly yellowish oil which crystallises out when left to stand.

Yield: 5.4 g (81.4 % of theory)



calc.: molar peak (M+H)<sup>+</sup>: 266      fnd.: molar peak (M+H)<sup>+</sup>: 266

R<sub>f</sub> value: 0.4 (silica gel, petroleum ether/EtOAc 6:4).

- 5    2.120c. tert.butyl {2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethyl}-carbaminate  
0.66 mL (8.5 mmol) of methanesulphonic acid chloride, dissolved in 10 mL  
CH<sub>2</sub>Cl<sub>2</sub>, are added dropwise to a solution of 2.89 g (10.89 mmol) of tert.butyl {2-[4-  
(1-hydroxy-ethyl)-phenyl]-ethyl}-carbaminate in 50 mL CH<sub>2</sub>Cl<sub>2</sub> and 1.25 ml  
triethylamine cooled to 0°C. Stirring is continued for 1 h at this temperature and  
10    then a solution of 1.4 mL (17 mmol) of pyrrolidine in 10 mL CH<sub>2</sub>Cl<sub>2</sub> is slowly added  
dropwise. The reaction mixture is stirred overnight at RT, combined with dilute  
KHSO<sub>4</sub> solution, the organic phase is separated off, washed twice with dilute  
KHSO<sub>4</sub> solution, the combined aqueous phases are made basic with K<sub>2</sub>CO<sub>3</sub>  
solution and exhaustively extracted with tert-butylmethylether. The combined  
15    organic phases are washed several times with a little water and dried over MgSO<sub>4</sub>.  
After elimination of the drying agent and solvent the product is further reacted  
without purification.

Yield: 0.3 g (8.7 % of theory)



- 20    calc.: molar peak (M+H)<sup>+</sup>: 319      fnd.: molar peak (M+H)<sup>+</sup>: 319  
R<sub>f</sub> value: 0.22 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 9:1:0.1).

- 2.120d. 2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethylamine  
0.72 mL trifluoroacetic acid are added to a solution of 300 mg (0.94 mmol) of  
25    tert.butyl {2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethyl}-carbaminate in 20 mL CH<sub>2</sub>Cl<sub>2</sub>  
and stirred for 1 h at RT. To complete the reaction a further 0.72 mL of  
trifluoroacetic acid are added and the reaction mixture is kept for 1 h at RT.  
The solvent is evaporated down in vacuo, the residue is taken up in water, made  
alkaline with 2 N NaOH, exhaustively extracted with EtOAc and the organic phase

is dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the product is further reacted without purification.

Yield: 150 mg (72.9 % of theory)

C<sub>14</sub>H<sub>22</sub>N<sub>2</sub> (M= 218.35)

5 calc.: molar peak (M+H)<sup>+</sup>: 219      fnd.: molar peak (M+H)<sup>+</sup>: 219

R<sub>f</sub> value: 0.15 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 8:2:0.2).

2.120e. 4'-chloro-biphenyl-4-carboxylic acid {2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethyl}-amide

10 Prepared according to general working method I from 150 mg (0.69 mmol) of 2-[4-(1-pyrrolidin-1-yl-ethyl)-phenyl]-ethylamine and 176 mg (0.76 mmol) of 4'-chlorobiphenyl-4-carboxylic acid.

Yield: 150 mg (88.3 % of theory)

C<sub>27</sub>H<sub>29</sub>CIN<sub>2</sub>O (M= 433.0)

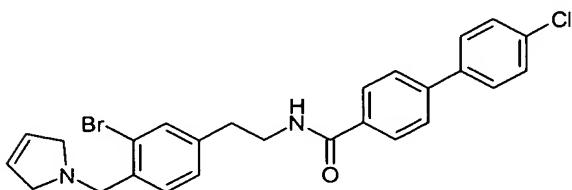
15 calc.: molar peak (M+H)<sup>+</sup>: 433/435      fnd.: molar peak (M+H)<sup>+</sup>: 433/435

Retention time HPLC: 6.33 min (method A)

### Example 2.121:

4'-chloro-biphenyl-4-carboxylic acid {2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-

20 phenyl]-ethyl}-amide



2.121a. [4-(2-amino-ethyl)-2-bromo-phenyl]-methanol

100 mg of Raney nickel are added to a solution of 4 g (17.68 mmol) of (3-bromo-4-hydroxymethyl-phenyl)-acetonitrile (cf. Example 2.107c.) in 100 mL THF and 50 mL methanolic NH<sub>3</sub> and the reaction mixture is shaken in a Parr autoclave for 5 h

at RT and 5 psi H<sub>2</sub>. The catalyst is filtered off, the solvent removed and the product is further reacted without purification.

Yield: 3.8 g (93.4 % of theory)

C<sub>9</sub>H<sub>12</sub>BrNO (M= 230.11)

5 calc.: molar peak (M+H)<sup>+</sup>: 230/232      fnd.: molar peak (M+H)<sup>+</sup>: 230/232

Retention time HPLC: 1.85 min (method A)

2.121b. tert.butyl [2-(3-bromo-4-hydroxymethyl-phenyl)-ethyl]-carbaminate

17 mL of a 1 M BOC-anhydride solution in CH<sub>2</sub>Cl<sub>2</sub> are added to a solution of 3.8 g (16.51 mmol) of [4-(2-amino-ethyl)-2-bromo-phenyl]-methanol in 50 mL CH<sub>2</sub>Cl<sub>2</sub> and the reaction mixture is stirred overnight at RT. It is diluted with 100 mL of dilute KHSO<sub>4</sub> solution, the organic phase is separated off, washed with dilute NaHCO<sub>3</sub> solution and water and dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by chromatography on silica gel.

15 Yield: 2.3 g (42.2 % of theory)

C<sub>14</sub>H<sub>20</sub>BrNO<sub>3</sub> (M= 330.22)

R<sub>f</sub> value: 0.44 (silica gel, petroleum ether/EtOAc 6:4).

2.121c. tert.butyl [2-(3-bromo-4-chloromethyl-phenyl)-ethyl]-carbaminate

20 0.54 mL (6.5 mmol) of thionyl chloride are slowly added dropwise to a solution of 1.98 g (6.0 mmol) of tert.butyl [2-(3-bromo-4-hydroxymethyl-phenyl)-ethyl]-carbaminate in 50 mL CH<sub>2</sub>Cl<sub>2</sub> and 0.53 mL pyridine cooled to 0°C, stirred for a further hour at 0°C and then heated to RT. Water is added to the reaction mixture, the organic phase is washed with dilute KHSO<sub>4</sub> solution and water and dried over MgSO<sub>4</sub>. After filtration through activated charcoal and elimination of the solvent the product is further reacted without purification.

25 Yield: 2.0 g (95.6 % of theory)

C<sub>14</sub>H<sub>19</sub>BrClNO<sub>2</sub> (M= 348.67)

calc.: molar peak (M+H)<sup>+</sup>: 348/350/352      fnd.: molar peak (M+H)<sup>+</sup>:

30 348/350/352

R<sub>f</sub> value: 0.6 (silica gel, petroleum ether/EtOAc 6:4).

2.121d. tert.butyl {2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-carbaminate

5 0.84 mL (11 mmol) of 2,5-dihydro-1H-pyrrole are added to a suspension of 1.9 g (5.45 mmol) of tert.butyl [2-(3-bromo-4-chloromethyl-phenyl)-ethyl]-carbaminate and 2.5 g (18.1 mmol) of K<sub>2</sub>CO<sub>3</sub> in 50 mL acetonitrile and the reaction mixture is stirred overnight at RT. The suspension is filtered, the filtrate evaporated down *in vacuo* and the residue purified by chromatography on silica gel.

10 Yield: 0.5 g (24.1 % of theory)

C<sub>18</sub>H<sub>25</sub>BrN<sub>2</sub>O<sub>2</sub> (M= 381.32)

calc.: molar peak (M+H)<sup>+</sup>: 381/383      fnd.: molar peak (M+H)<sup>+</sup>: 381/383

R<sub>f</sub> value: 0.58 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 8:2).

15 2.121e. 2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethylamine

5 mL trifluoroacetic acid are added to a solution of 500 mg (1.31 mmol) of tert.butyl {2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-carbaminate in 50 mL CH<sub>2</sub>Cl<sub>2</sub> and the reaction mixture is stirred for 2 h at RT.

It is evaporated down *in vacuo*, combined with water and CH<sub>2</sub>Cl<sub>2</sub>, adjusted to an

20 alkaline pH with K<sub>2</sub>CO<sub>3</sub> solution, the organic phase is separated off and washed again with water. This is evaporated down *in vacuo* and the product is purified by chromatography on silica gel.

Yield: 350 mg (95.0 % of theory)

C<sub>13</sub>H<sub>17</sub>BrN<sub>2</sub> (M= 281.20)

25 calc.: molar peak (M+H)<sup>+</sup>: 281/283      fnd.: molar peak (M+H)<sup>+</sup>: 281/283

R<sub>f</sub> value: 0.08 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 95:5:0.5).

2.121f. 4'-chloro-biphenyl-4-carboxylic acid {2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-amide

Prepared according to general working method I from 141 mg (0.5 mmol) of 2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethylamine and 116 mg (0.5 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 140 mg (56.5 % of theory)

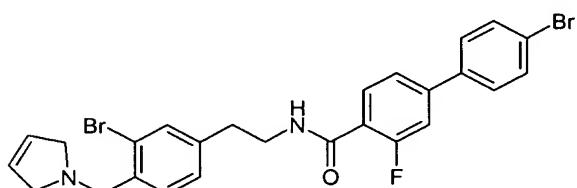
5 C<sub>26</sub>H<sub>24</sub>BrCIN<sub>2</sub>O (M= 495.85)

calc.: molar peak (M+H)<sup>+</sup>: 495/497/499      fnd.: molar peak (M+H)<sup>+</sup>:  
495/497/499

Retention time HPLC: 6.6 min (method A)

10 **Example 2.122:**

4'-bromo-3-fluoro-biphenyl-4-carboxylic acid {2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-amide



15 2.122a. 4'-bromo-3-fluoro-biphenyl-4-carboxylic acid

1.04 g (5 mmol) of 4-bromophenylboric acid, 115 mg (0.1 mmol) of tetrakis-(triphenylphosphine)-palladium and 2 ml 2M Na<sub>2</sub>CO<sub>3</sub> solution are added successively to a solution of 1.1 g (5 mmol) of 4-bromo-2-fluorobenzoic acid in 5 mL DMF and 5 mL dioxane and the reaction mixture is refluxed for 2 h. To

20 complete the reaction a further 250 mg (1.25 mmol) of 4-bromophenylboric acid are added and the mixture is refluxed for a further 2 h. The reaction mixture is filtered hot through a glass fibre filter, washed with water, acidified with dilute KHSO<sub>4</sub> solution, the precipitate formed is suction filtered and washed with water. The residue is triturated with acetonitrile and a little MeOH, filtered to remove  
25 insoluble matter, the filtrate is evaporated down, the residue is triturated with MeOH and the product is suction filtered.

Yield: 140 mg (9.5 % of theory)

C<sub>13</sub>H<sub>8</sub>BrFO<sub>2</sub> (M= 295.11)

calc.: molar peak (M+H)<sup>+</sup>: 293/295      fnd.: molar peak (M+H)<sup>+</sup>: 293/295

R<sub>f</sub> value: 0.5 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH 9:1).

- 5    2.122b. 4'-bromo-3-fluoro-biphenyl-4-carboxylic acid {2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethyl}-amide

Prepared according to general working method I from 141 mg (0.5 mmol) of 2-[3-bromo-4-(2,5-dihydro-pyrrol-1-ylmethyl)-phenyl]-ethylamine and 140 mg (0.47 mmol) of 4'-bromo-3-fluoro-biphenyl-4-carboxylic acid.

- 10   Yield: 10 mg (3.8 % of theory)

C<sub>26</sub>H<sub>23</sub>Br<sub>2</sub>FN<sub>2</sub>O (M= 558.29)

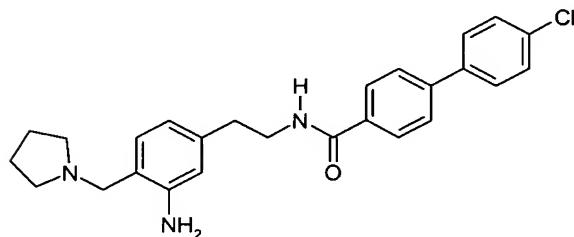
calc.: molar peak (M+H)<sup>+</sup>: 557/559/561      fnd.: molar peak (M+H)<sup>+</sup>: 557/559/561

Retention time HPLC: 7.0 min (method A)

15

**Example 2.123:**

4'-chloro-biphenyl-4-carboxylic acid [2-(3-amino-4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



20

0.12 mL trifluoroacetic acid are added to a solution of 40 mg (0.08 mmol) of tert.butyl (5-{2-[(4'-chloro-biphenyl-4-carbonyl)-amino]-ethyl}-2-pyrrolidin-1-ylmethyl-phenyl)-carbaminonate (cf. Example 2.116) in 3 mL CH<sub>2</sub>Cl<sub>2</sub> and the reaction mixture is stirred at RT over the weekend. It is evaporated down in vacuo,

25   combined with semisaturated NaHCO<sub>3</sub> solution, extracted with EtOAc and the

organic phase is dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is purified by HPLC.

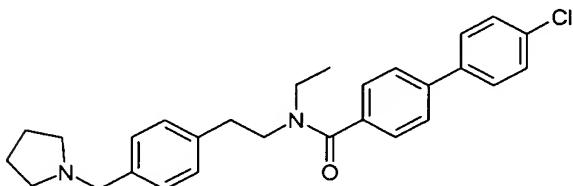
Yield: 3 mg (7.3 % of theory)



- 5 calc.: molar peak (M+H)<sup>+</sup>: 434/436      fnd.: molar peak (M+H)<sup>+</sup>: 434/436  
Retention time HPLC: 5.35 min (Stable Bond C18; 3.5 μM;  
water:acetonitrile:formic acid 6:4:0.015)

**Example 2.124:**

- 10 4'-chloro-biphenyl-4-carboxylic acid-ethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



**2.124a. ethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine**

- 15 A solution of 89 μL (1.1 mmol) of ethyl iodide in 1 mL THF is added dropwise to a solution of 204 mg (1.0 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 0.17 mL triethylamine in 5 mL THF and the reaction mixture is stirred for 24 h at RT. It is combined with saturated NaHCO<sub>3</sub> solution, extracted with EtOAc and the organic phase is dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is further reacted without purification.
- 20 Yield: 70 mg (30.1 % of theory).

**2.124b. 4'-chloro-biphenyl-4-carboxylic acid-ethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide**

- 25 Prepared according to general working method I from 70 mg (0.3 mmol) of ethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine and 81 mg (0.35 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 20 mg (14.9 % of theory)

C<sub>28</sub>H<sub>31</sub>ClN<sub>2</sub>O (M= 447.03)

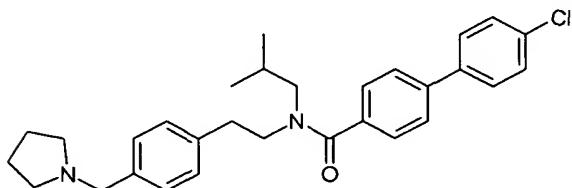
calc.: molar peak (M+H)<sup>+</sup>: 447/449      fnd.: molar peak (M+H)<sup>+</sup>: 447/449

Retention time HPLC: 6.92 min (method A)

5

**Example 2.125:**

4'-chloro-biphenyl-4-carboxylic acid-isobutyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



10

2.125a. isobutyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine

A solution of 204 mg (1.0 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 91  $\mu$ L (1.0 mmol) of isobutyraldehyde in 20 mL THF is acidified slightly with glacial acetic acid, combined with 253 mg (1.2 mmol) of NaBH(OAc)<sub>3</sub> and stirred overnight at RT. The reaction mixture is combined with semisaturated NaHCO<sub>3</sub> solution, exhaustively extracted with EtOAc; the aqueous phase is saturated with K<sub>2</sub>CO<sub>3</sub> and extracted with EtOAc. The combined organic phases are dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the residue is further reacted without purification.

15

Yield: 250 mg (96.0 % of theory).

C<sub>17</sub>H<sub>28</sub>N<sub>2</sub> (M= 260.43)

calc.: molar peak (M+H)<sup>+</sup>: 261      fnd.: molar peak (M+H)<sup>+</sup>: 261

R<sub>f</sub> value: 0.4 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 8:2:0.2).

20

2.125b. 4'-chloro-biphenyl-4-carboxylic acid-isobutyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 250 mg (0.96 mmol) of isobutyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine and 244 mg (1.05 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 67 mg (14.7 % of theory)

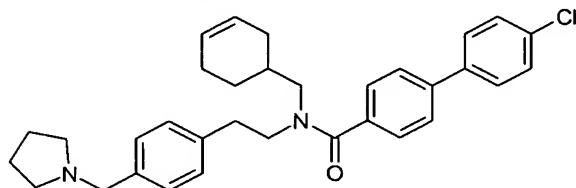
5 C<sub>30</sub>H<sub>35</sub>CIN<sub>2</sub>O (M= 475.08)

calc.: molar peak (M+H)<sup>+</sup>: 475/477      fnd.: molar peak (M+H)<sup>+</sup>: 475/477

Retention time HPLC: 7.67 min (method A)

**Example 2.126:**

10 4'-chloro-biphenyl-4-carboxylic acid-cyclohex-3-enylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



**2.126a. cyclohex-3-enylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine**

15 Prepared analogously to Example 2.125a. from 204 mg (1.0 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 114 µL (1.0 mmol) of 1,2,3,6-tetrahydrobenzaldehyde.

Yield: 100 mg (33.5 % of theory).

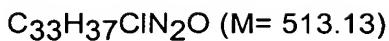
C<sub>20</sub>H<sub>30</sub>N<sub>2</sub> (M= 298.48)

20 R<sub>f</sub> value: 0.2 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 8:2:0.2).

**2.126b. 4'-chloro-biphenyl-4-carboxylic acid-cyclohex-3-enylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide**

Prepared according to general working method I from 100 mg (0.34 mmol) of cyclohex-3-enylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine and 86 mg (0.37 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 46 mg (26.8 % of theory)

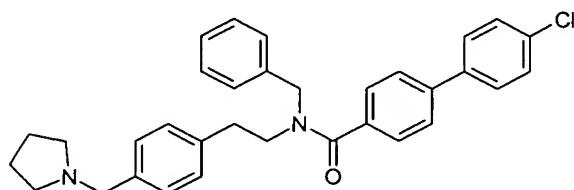


calc.: molar peak (M+H)<sup>+</sup>: 513/515      fnd.: molar peak (M+H)<sup>+</sup>: 513/515

Retention time HPLC: 8.20 min (method A)

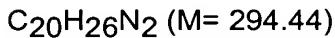
5   **Example 2.127:**

4'-chloro-biphenyl-4-carboxylic acid-benzyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



10   **2.127a.** benzyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine

Prepared analogously to Example 2.125a. from 204 mg (1.0 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 102  $\mu$ L (1.0 mmol) of benzaldehyde. Yield: 160 mg (54.3 % of theory).



15   R<sub>f</sub> value: 0.28 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 8:2:0.2).

**2.127b.** 4'-chloro-biphenyl-4-carboxylic acid-benzyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 160 mg (0.54 mmol) of 20   benzyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine and 140 mg (0.60 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 16 mg (5.8 % of theory)

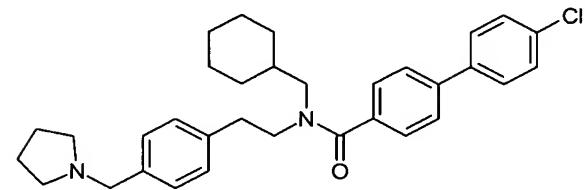


calc.: molar peak (M+H)<sup>+</sup>: 509/511      fnd.: molar peak (M+H)<sup>+</sup>: 509/511

25   Retention time HPLC: 7.51 min (method A)

**Example 2.128:**

4'-chloro-biphenyl-4-carboxylic acid-cyclohexylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



5

2.128a. cyclohexylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine

Prepared analogously to Example 2.125a. from 204 mg (1.0 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 121  $\mu$ L (1.0 mmol) of cyclohexanecarbaldehyde.

10 Yield: 100 mg (33.3 % of theory).

C<sub>20</sub>H<sub>32</sub>N<sub>2</sub> (M= 300.49)

R<sub>f</sub> value: 0.18 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 8:2:0.2).

2.128b. 4'-chloro-biphenyl-4-carboxylic acid-cyclohexylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

15 Prepared according to general working method I from 100 mg (0.33 mmol) of cyclohexylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine and 86 mg (0.37 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

Yield: 70 mg (40.8 % of theory)

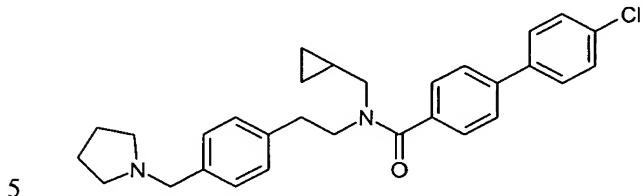
20 C<sub>33</sub>H<sub>33</sub>ClN<sub>2</sub>O (M= 515.15)

calc.: molar peak (M+H)<sup>+</sup>: 515/517      fnd.: molar peak (M+H)<sup>+</sup>: 515/517

Retention time HPLC: 8.63 min (method A)

**Example 2.129:**

4'-chloro-biphenyl-4-carboxylic acid-cyclopropylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide



2.129a. cyclopropylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine

Prepared analogously to Example 2.125a. from 204 mg (1.0 mmol) of 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine and 75  $\mu$ L (1.0 mmol) of

10 cyclopropanecarbaldehyde.

Yield: 100 mg (38.7 % of theory).

C<sub>17</sub>H<sub>26</sub>N<sub>2</sub> (M= 258.41)

R<sub>f</sub> value: 0.30 (silica gel, CH<sub>2</sub>Cl<sub>2</sub>/MeOH/NH<sub>3</sub> 8:2:0.2).

15 2.129b. 4'-chloro-biphenyl-4-carboxylic acid-cyclopropylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amide

Prepared according to general working method I from 100 mg (0.39 mmol) of cyclopropylmethyl-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-amine and 100 mg (0.43 mmol) of 4'-chloro-biphenyl-4-carboxylic acid.

20 Yield: 23 mg (12.6 % of theory)

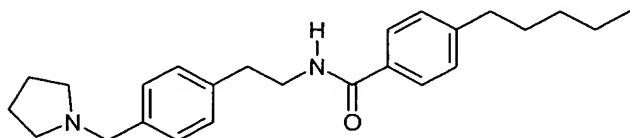
C<sub>30</sub>H<sub>33</sub>ClN<sub>2</sub>O (M= 473.06)

calc.: molar peak (M+H)<sup>+</sup>: 473/475      fnd.: molar peak (M+H)<sup>+</sup>: 473/475

Retention time HPLC: 7.45 min (method A)

**Example 2.130:**

4-pentyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



5

Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol) and 4-pentyl-benzoic acid (96 mg, 0.50 mmol).

Yield: 75 mg (39.6 % of theory)

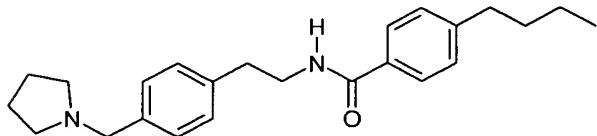
10 C<sub>25</sub>H<sub>34</sub>N<sub>2</sub>O (M= 378.56)

calc.: molar peak (M+H)<sup>+</sup>: 379      fnd.: molar peak (M+H)<sup>+</sup>: 379

Retention time HPLC: 6.5 min (method A)

**Example 2.131:**

15 4-butyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol) and 4-butyl-benzoic acid (89 mg, 0.50 mmol).

20 Yield: 60 mg (32.9 % of theory)

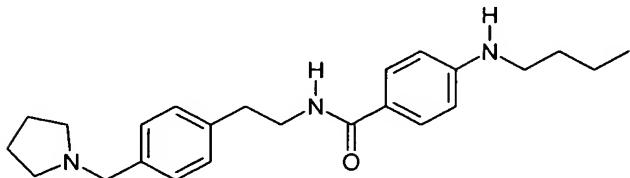
C<sub>24</sub>H<sub>32</sub>N<sub>2</sub>O (M= 364.54)

calc.: molar peak (M+H)<sup>+</sup>: 365      fnd.: molar peak (M+H)<sup>+</sup>: 365

Retention time HPLC: 6.0 min (method A)

**Example 2.132:**

4-butylamino-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



5

Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (204 mg, 1.0 mmol) and 4-butylamino-benzoic acid (155 mg, 0.80 mmol).

Yield: 30 mg (9.9 % of theory)

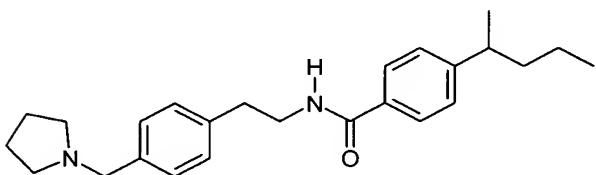
10 C<sub>24</sub>H<sub>33</sub>N<sub>3</sub>O (M= 379.55)

calc.: molar peak (M+H)<sup>+</sup>: 380      fnd.: molar peak (M+H)<sup>+</sup>: 380

Retention time HPLC: 6.0 min (method A)

**Example 2.133:**

15 4-(1-methyl-butyl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (82 mg, 0.40 mmol) and 4-(1-methyl-butyl)-benzoic acid (75 mg, 0.39 mmol).

20 Yield: 40 mg (27.1 % of theory)

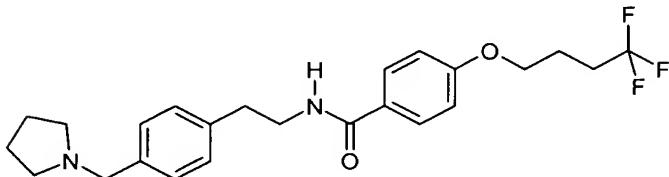
C<sub>24</sub>H<sub>32</sub>N<sub>2</sub>O (M= 378.56)

calc.: molar peak (M+H)<sup>+</sup>: 379      fnd.: molar peak (M+H)<sup>+</sup>: 379

Retention time HPLC: 4.3 min (method B)

**Example 2.134:**

*N*-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-4-(4,4,4-trifluoro-butoxy)-benzamide



5    2.134a. methyl 4-(4,4,4-trifluoro-butoxy)-benzoate

608 mg (4.4 mmol) of  $K_2CO_3$  are added to a solution of 304 mg (2.0 mmol) of methyl 4-hydroxybenzoate in 10 mL DMF and then 382 mg (2.0 mmol) of 1-bromo-4,4,4-trifluorobutane. The mixture is stirred overnight at RT, again combined with 1-bromo-4,4,4-trifluorobutane and stirred for a further 24 h at RT. The reaction 10 solution is diluted with water and exhaustively extracted twice with EtOAc. The combined org. extracts are dried over  $MgSO_4$  and evaporated down i. vac.. The crude product is used without further purification in the next reaction step.

Yield: 500 mg (95.3 % of theory)

$C_{12}H_{13}F_3O_3$  ( $M = 262.23$ )

15    calc.: molar peak  $(M+H)^+$ : 263              fnd.: molar peak  $(M+H)^+$ : 263

$R_f$  value: 0.9 (silica gel, petroleum ether/EtOAc 6:4).

2.134b. 4-(4,4,4-trifluoro-butoxy)-benzoic acid

10.0 mL (10.0 mmol) of 1M sodium hydroxide solution are added to a solution of 20 500 mg (1.9 mmol) of methyl 4-(4,4,4-trifluoro-butoxy)-benzoate in 7 mL THF. The mixture is stirred for 8 h under reflux. THF is removed i. vac. and the residue is acidified with hydrochloric acid. After filtration the precipitate formed is dried in the air.

Yield: 350 mg (73.9 % of theory)

25     $C_{11}H_{11}F_3O_3$  ( $M = 248.20$ )

calc.: molar peak  $(M-H)^-$ : 247              fnd.: molar peak  $(M-H)^-$ : 247

Retention time HPLC: 7.5 min (method A)

2.134c. *N*-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-4-(4,4,4-trifluoro-butoxy)-benzamide

Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol) and 4-(4,4,4-trifluoro-butoxy)-benzoic

5 acid (124 mg, 0.50 mmol).

Yield: 37 mg (17.0 % of theory)

C<sub>24</sub>H<sub>29</sub>F<sub>3</sub>N<sub>2</sub>O<sub>2</sub> (M= 434.51)

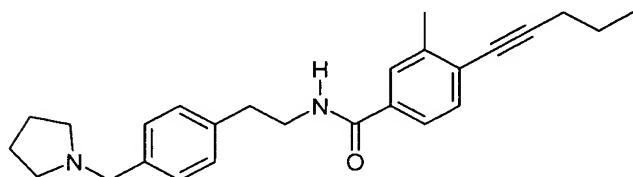
calc.: molar peak (M+H)<sup>+</sup>: 435      fnd.: molar peak (M+H)<sup>+</sup>: 435

Retention time HPLC: 5.8 min (method A)

10

**Example 2.135:**

3-methyl-4-pent-1-ynyl-*N*-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



15 2.135a. methyl 3-methyl-4-pent-1-ynyl-benzoate

0.39 mL (4.0 mmol) of pentyne, 0.56 mL (4.0 mmol) of triethylamine, 70 mg (0.1 mmol) of bis-(triphenylphosphine)-palladium(II)-chloride and 19 mg (0.1 mmol) of copper(I)-iodide are added successively to a solution of 458 mg (2.0 mmol) of methyl 4-bromo-3-methyl-benzoate in 3.0 mL DMF. The reaction solution is stirred

20 in the microwave for 10 min at 200 Watt and 65°C. A further 0.20 mL (2.0 mmol) of pentyne are added and the reaction solution is stirred for a further 20 min in the microwave at 200 Watt and 70°C. The mixture is diluted with 30 mL EtOAc, filtered through Celite and the filtrate is washed three times with 50 mL water. The combined organic extracts are dried over MgSO<sub>4</sub>, filtered through activated charcoal and the solvent is eliminated i. vac.. The purification is carried out by column chromatography on silica gel (cyclohexane after cyclohexane/ ethyl acetate 9:1).

Yield: 200 mg (46.2 % of theory)

C<sub>14</sub>H<sub>16</sub>O<sub>2</sub> (M= 216.28)

calc.: molar peak (M+H)<sup>+</sup>: 217      fnd.: molar peak (M+H)<sup>+</sup>: 217

Retention time HPLC: 6.8 min (method B)

5

2.135b. 3-methyl-4-pent-1-ynyl-benzoic acid

3.0 mL (3.0 mmol) of 1M sodium hydroxide solution are added to a solution of 200 mg (0.93 mmol) of methyl 3-methyl-4-pent-1-ynyl-benzoate in 3 mL methanol. The mixture is refluxed for 3 h. The reaction solution is diluted with water and extracted 10 once with 40 mL of EtOAc. The aqueous phase is acidified with 1M KHSO<sub>4</sub> solution and extracted twice with 40 mL EtOAc. The combined organic phases are dried over MgSO<sub>4</sub>. After elimination of the drying agent and solvent the crude product is used in the next reaction step without further purification.

Yield: 50 mg (26.7 % of theory)

15 C<sub>13</sub>H<sub>14</sub>O<sub>2</sub> (M= 202.26)

calc.: molar peak (M-H)<sup>-</sup>: 201      fnd.: molar peak (M-H)<sup>-</sup>: 201

Retention time HPLC: 5.6 min (method B)

2.135c. 3-methyl-4-pent-1-ynyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (51 mg, 0.25 mmol) and 3-methyl-4-pent-1-ynyl-benzoic acid (50 mg, 0.25 mmol).

Yield: 22 mg (22.9 % of theory)

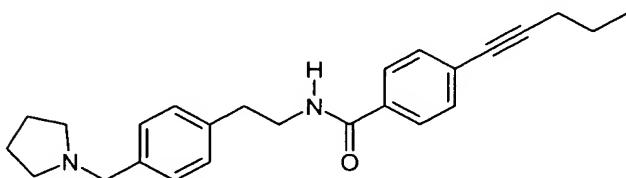
25 C<sub>26</sub>H<sub>32</sub>N<sub>2</sub>O (M= 388.558)

calc.: molar peak (M+H)<sup>+</sup>: 389      fnd.: molar peak (M+H)<sup>+</sup>: 389

Retention time HPLC: 6.9 min (method A)

**Example 2.136:**

4-pent-1-ynyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



5

2.136a. ethyl 4-pent-1-ynyl-benzoate

0.39 mL (4 mmol) of 1-pentyne, 0.56 mL triethylamine, 70 mg (0.1 mmol) of bis-(triphenylphosphine)-palladium(II)-chloride and 19 mg (0.1 mmol) of CuI are added successively to a solution of 552 mg (2.0 mmol) of ethyl 4-iodobenzoate in 3 mL

10 DMF. The reaction solution is stirred for 4 h at 80°C. The mixture is diluted with 30 mL EtOAc, filtered through Celite, the filtrate is washed three times with 50 mL water in each case and dried over MgSO<sub>4</sub>. After filtration through activated charcoal the solvent is eliminated in vacuo. The purification is carried out by column chromatography on silica gel (cyclohexane after cyclohexane/ ethyl acetate 9:1).

15 Yield: 150 mg (34.7 % of theory)

C<sub>14</sub>H<sub>16</sub>O<sub>2</sub> (M= 216.282)

calc.: molar peak (M+H)<sup>+</sup>: 217      fnd.: molar peak (M+H)<sup>+</sup>: 217

Retention time HPLC: 6.8 min (method B)

20

2.136b. 4-pent-1-ynyl-benzoic acid

5.0 mL (5.0 mmol) of 1M sodium hydroxide solution are added to a solution of 150 mg (0.69 mmol) of ethyl 4-pent-1-ynyl-benzoate in 3 mL methanol. The mixture is stirred for 3 h under reflux. The reaction solution is diluted with water and

25 extracted once with 40 mL EtOAc. The aqueous phase is acidified with 1M KHSO<sub>4</sub> solution and extracted twice with 40 mL EtOAc. The combined organic extracts are dried over magnesium sulphate and the solvent is eliminated i. vac. The crude product was used in the next reaction step without further purification.

Yield: 150 mg (115 % of theory)

C<sub>12</sub>H<sub>12</sub>O<sub>2</sub> (M= 188.23)

calc.: molar peak (M-H)<sup>-</sup>: 187      fnd.: molar peak (M-H)<sup>-</sup>: 187

R<sub>f</sub> value: 0.2 (silica gel, petroleum ether/EtOAc 8:2).

5

2.136c. 4-pent-1-ynyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (163 mg, 0.80 mmol) and 4-pent-1-ynyl-benzoic acid (150 mg, 0.80 mmol).

10 Yield: 122 mg (40.9 % of theory)

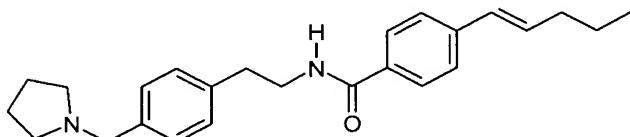
C<sub>25</sub>H<sub>30</sub>N<sub>2</sub>O (M= 374.53)

calc.: molar peak (M+H)<sup>+</sup>: 375      fnd.: molar peak (M+H)<sup>+</sup>: 375

R<sub>f</sub> value: 0.35 (silica gel, EtOAc/methanol/NH<sub>3</sub> 9:1:0.1).

15 **Example 2.137:**

(4-pent-1-enyl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



2.137a. methyl 4-pent-1-enyl-benzoate

20 246 mg (2.2 mmol) of potassium-*tert*-butoxide are added at 0°C to a solution of 1.08 g (2.2 mmol) of (4-methoxycarbonyl-benzyl)-triphenyl-phosphonium-bromide in 20 mL of THF under an argon atmosphere. The orange solution is stirred for a further 15 min at 0°C and then combined with 0.18 mL (2.0 mmol) of butyraldehyde. The reaction solution is refluxed for 3h and then diluted with EtOAc. The organic phase is washed twice with water, dried over magnesium sulphate and the solvent is removed i. vac.. The residue is triturated with diisopropylether, filtered and the filtrate is evaporated down. The further purification is carried out by column chromatography on silica gel (petroleum ether/

EtOAc 6:4). Methyl 4-pent-1-enyl-benzoate is obtained as a 2:1 mixture of E/Z isomers.

Yield: 350 mg (56.5 % of theory)

C<sub>13</sub>H<sub>16</sub>O<sub>2</sub> (M= 204.27)

5 calc.: molar peak (M+H)<sup>+</sup>: 204      fnd.: molar peak (M+H)<sup>+</sup>: 204

R<sub>f</sub> value: 0.90 (silica gel, petroleum ether/EtOAc 6:4).

2.137b. 4-pent-1-enyl-benzoic acid

5.0 mL (5.0 mmol) of 1M sodium hydroxide solution are added to a solution of 350  
10 mg (1.71 mmol) of ethyl 4-pent-1-enyl-benzoate in 4 mL methanol. The mixture  
was refluxed for 2 h. The solvent is removed i. vac. and the residue is combined  
with 6M hydrochloric acid solution. The precipitate formed is suction filtered and  
dried at 35°C in the circulating air dryer. The further purification is carried out by  
filtration through a silica gel column (petroleum ether/ EtOAc 6:4).

15 Yield: 300 mg (92.1 % of theory)

C<sub>12</sub>H<sub>14</sub>O<sub>2</sub> (M= 190.24)

calc.: molar peak (M-H)<sup>-</sup>: 189      fnd.: molar peak (M-H)<sup>-</sup>: 189

R<sub>f</sub> value: 0.4 (silica gel, petroleum ether/EtOAc 6:4).

20 2.137c. (4-pent-1-enyl)-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide

Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (306 mg, 1.50 mmol) and 4-pent-1-enyl-benzoic acid (300 mg, 1.56 mmol) as a 2:1 mixture of E/Z isomers.

Yield: 130 mg (23.0 % of theory)

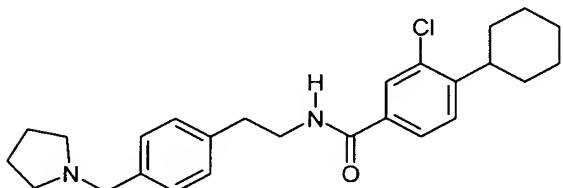
25 C<sub>25</sub>H<sub>32</sub>N<sub>2</sub>O (M= 376.547)

calc.: molar peak (M+H)<sup>+</sup>: 377      fnd.: molar peak (M+H)<sup>+</sup>: 377

Retention time HPLC: 6.9 min (method A)

**Example 2.138:**

3-chloro-4-cyclohexyl-N-[2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethyl]-benzamide



- 5 Prepared according to general working method I from 2-(4-pyrrolidin-1-ylmethyl-phenyl)-ethylamine (102 mg, 0.50 mmol) and 3-chloro-4-cyclohexyl-benzoic acid (119 mg, 0.50 mmol).  
Yield: 46 mg (21.6 % of theory)  
 $C_{26}H_{33}ClN_2O$  ( $M= 425.019$ )
- 10 calc.: molar peak  $(M+H)^+$ : 425/427      fnd.: molar peak  $(M+H)^+$ : 425/427  
Retention time HPLC: 4.7 min (method B)

Some test methods for determining an MCH-receptor antagonistic activity will now  
15 be described. In addition, other test methods known to the skilled man are used,  
e.g. by inhibiting the MCH-receptor-mediated inhibition of cAMP production, as  
described by Hoogduijn M et al. in "Melanin-concentrating hormone and its  
receptor are expressed and functional in human skin", Biochem. Biophys. Res  
Commun. 296 (2002) 698-701 and by biosensory measurement of the binding of  
20 MCH to the MCH receptor in the presence of antagonistic substances by plasmon  
resonance, as described by Karlsson OP and Lofas S. in "Flow-Mediated On-  
Surface Reconstitution of G-Protein Coupled Receptors for Applications in Surface  
Plasmon Resonance Biosensors", Anal. Biochem. 300 (2002), 132-138. Other  
methods of testing antagonistic activity to MCH receptors are contained in the  
25 references and patent documents mentioned hereinbefore, and the description of  
the test methods used is hereby incorporated in this application.

**MCH-1 receptor binding test**

- Method: MCH binding to hMCH-1R transfected cells  
Species: Human  
Test cell: hMCH-1R stably transfected into CHO/Galpha16 cells
- 5 Results: IC50 values  
Membranes from CHO/Galpha16 cells stably transfected with human hMCH-1R are resuspended using a syringe (needle 0.6 x 25 mm) and diluted in test buffer (50 mM HEPES, 10 mM MgCl<sub>2</sub>, 2 mM EGTA, pH 7.00; 0.1 % bovine serum albumin (protease-free), 0.021 % bacitracin, 1 µg/ml aprotinin, 1 µg/ml leupeptin  
10 and 1 µM phosphoramidon) to a concentration of 5 to 15 µg/ml.  
200 microlitres of this membrane fraction (contains 1 to 3 µg of protein) are incubated for 60 minutes at ambient temperature with 100 pM of <sup>125</sup>I-tyrosyl melanin concentrating hormone (<sup>125</sup>I-MCH commercially obtainable from NEN) and increasing concentrations of the test compound in a final volume of 250  
15 microlitres. After the incubation the reaction is filtered using a cell harvester through 0.5% PEI treated glass fibre filters (GF/B, Unifilter Packard). The membrane-bound radioactivity retained on the filter is then determined after the addition of scintillator substance (Packard Microscint 20) in a measuring device (TopCount of Packard).  
20 The non-specific binding is defined as bound radioactivity in the presence of 1 micromolar MCH during the incubation period.  
The analysis of the concentration binding curve is carried out on the assumption of one receptor binding site.  
Standard:  
25 Non-labelled MCH competes with labelled <sup>125</sup>I-MCH for the receptor binding with an IC50 value of between 0.06 and 0.15 nM.  
The KD value of the radioligand is 0.156 nM.

**MCH-1 receptor-coupled Ca<sup>2+</sup> mobilisation test**

- 30 Method: Calcium mobilisation test with human MCH (FLIPR<sup>384</sup>)  
Species: Human

Test cells: CHO/ Galpha 16 cells stably transfected with hMCH-R1  
Results: 1st measurement: % stimulation of the reference (MCH 10<sup>-6</sup>M)  
2nd measurement: pKB value

|           |                                      |                    |
|-----------|--------------------------------------|--------------------|
| Reagents: | HBSS (10x)                           | (GIBCO)            |
|           | HEPES buffer (1M)                    | (GIBCO)            |
|           | Pluronic F-127                       | (Molecular Probes) |
|           | Fluo-4                               | (Molecular Probes) |
|           | Probenecid                           | (Sigma)            |
|           | MCH                                  | (Bachem)           |
|           | bovine serum albumin (protease-free) | (Serva)            |
|           | DMSO                                 | (Serva)            |
|           | Ham's F12                            | (BioWhittaker)     |
|           | FCS                                  | (BioWhittaker)     |
|           | L-Glutamine                          | (GIBCO)            |
|           | Hygromycin B                         | (GIBCO)            |
|           | PENStrep                             | (BioWhittaker)     |
|           | Zeocin                               | (Invitrogen)       |

5

Clonal CHO/Galpah16 hMCH-R1 cells are cultivated in Ham's F12 cell culture medium (with L-glutamine; BioWhittaker; Cat.No.: BE12-615F). This contains per 500 ml 10% FCS, 1% PENStrep, 5 ml L-glutamine (200 mM stock solution), 3 ml hygromycin B (50 mg/ml in PBS) and 1.25 ml zeocin (100 µg/ml stock solution).

- 10 One day before the experiment the cells are plated on a 384-well microtitre plate (black-walled with a transparent base, made by Costar) in a density of 2500 cells per cavity and cultivated in the above medium overnight at 37°C, 5% CO<sub>2</sub> and 95% relative humidity. On the day of the experiment the cells are incubated with cell culture medium to which 2 mM Fluo-4 and 4.6 mM Probenecid have been added, at 37°C for 45 minutes. After charging with fluorescent dye the cells are washed four times with Hanks buffer solution (1 x HBSS, 20 mM HEPES), which is combined with 0.07% Probenecid. The test substances are diluted in Hanks buffer
- 15

solution, combined with 2.5% DMSO. The background fluorescence of non-stimulated cells is measured in the presence of substance in the 384-well microtitre plate five minutes after the last washing step in the FLIPR<sup>384</sup> apparatus (Molecular Devices; excitation wavelength: 488 nm; emission wavelength:

- 5 bandpass 510 to 570 nm). To stimulate the cells MCH is diluted in Hanks buffer with 0.1% BSA, pipetted into the 384-well cell culture plate 35 minutes after the last washing step and the MCH-stimulated fluorescence is then measured in the FLIPR<sup>384</sup> apparatus.

10 **Data analysis:**

1st measurement: The cellular Ca<sup>2+</sup> mobilisation is measured as the peak of the relative fluorescence minus the background and is expressed as the percentage of the maximum signal of the reference (MCH 10<sup>-6</sup>M). This measurement serves to identify any possible agonistic effect of a test substance.

- 15 2nd measurement: The cellular Ca<sup>2+</sup> mobilisation is measured as the peak of the relative fluorescence minus the background and is expressed as the percentage of the maximum signal of the reference (MCH 10<sup>-6</sup>M, signal is standardised to 100%). The EC50 values of the MCH dosage activity curve with and without test substance (defined concentration) are determined graphically by the GraphPad Prism 2.01 curve program. MCH antagonists cause the MCH stimulation curve to shift to the right in the graph plotted.
- 20

The inhibition is expressed as a pKB value:

$$pKB = \log(EC_{50}(\text{testsubstance+MCH}) / EC_{50}(\text{MCH}) - 1) - \log c_{(\text{testsubstance})}$$

25

The compounds according to the invention, including their salts, exhibit an MCH-receptor antagonistic activity in the tests mentioned above. Using the MCH-1 receptor binding test described above an antagonistic activity is obtained in a dosage range from about 10<sup>-10</sup> to 10<sup>-5</sup> M, particularly from 10<sup>-9</sup> to 10<sup>-6</sup> M.

30

The following IC<sub>50</sub> values were determined using the MCH-1 receptor binding test described above:

| Compound according to Example No. | IC <sub>50</sub> value |
|-----------------------------------|------------------------|
| 1.14                              | 2.1 nM                 |
| 2.4                               | 3.5 nM                 |
| 2.12                              | 30.5 nM                |

- 5 Some examples of formulations will be described hereinafter, wherein the term "active substance" denotes one or more compounds according to the invention, including their salts. In the case of one of the combinations with one or more active substances described, the term "active substance" also includes the additional active substances.

10

Example 3

Capsules for powder inhalation containing 1 mg active substance

15 Composition:

1 capsule for powder inhalation contains:

|                        |                |
|------------------------|----------------|
| active substance       | 1.0 mg         |
| lactose                | 20.0 mg        |
| hard gelatine capsules | <u>50.0 mg</u> |
|                        | 71.0 mg        |

20

Method of preparation:

The active substance is ground to the particle size required for inhalation. The ground active substance is homogeneously mixed with the lactose. The mixture is packed into hard gelatine capsules.

25

Example 4

Inhalable solution for Respimat® containing 1 mg active substance

Composition:

5    1 spray contains:

|                       |        |    |
|-----------------------|--------|----|
| active substance      | 1.0    | mg |
| benzalkonium chloride | 0.002  | mg |
| disodium edetate      | 0.0075 | mg |
| purified water ad     | 15.0   | µl |

10

Method of preparation:

The active substance and benzalkonium chloride are dissolved in water and packed into Respimat® cartridges.

15

Example 5

Inhalable solution for nebulisers containing 1 mg active substance

Composition:

20    1 vial contains:

|                       |       |    |
|-----------------------|-------|----|
| active substance      | 0.1   | g  |
| sodium chloride       | 0.18  | g  |
| benzalkonium chloride | 0.002 | g  |
| purified water ad     | 20.0  | ml |

25

Method of preparation:

The active substance, sodium chloride and benzalkonium chloride are dissolved in water.

Example 6

Propellant type metered dose aerosol containing 1 mg active substance

5      Composition:

1 spray contains:

|                   |              |
|-------------------|--------------|
| active substance  | 1.0 mg       |
| lecithin          | 0.1 %        |
| propellant gas ad | 50.0 $\mu$ l |

10

Method of preparation:

The micronised active substance is homogeneously suspended in the mixture of lecithin and propellant gas. The suspension is transferred into a pressurised container with a metering valve.

15

Example 7

Nasal spray containing 1 mg active substance

Composition:

|                          |          |
|--------------------------|----------|
| 20      active substance | 1.0 mg   |
| sodium chloride          | 0.9 mg   |
| benzalkonium chloride    | 0.025 mg |
| disodium edetate         | 0.05 mg  |
| purified water ad        | 0.1 ml   |

25

Method of preparation:

The active substance and the excipients are dissolved in water and transferred into a corresponding container.

30      Example 8

Injectable solution containing 5 mg of active substance per 5 ml

**Composition:**

|                         |        |
|-------------------------|--------|
| active substance        | 5 mg   |
| glucose                 | 250 mg |
| 5 human serum albumin   | 10 mg  |
| glycofurool             | 250 mg |
| water for injections ad | 5 ml   |

**Preparation:**

- 10 Glycofurool and glucose are dissolved in water for injections (Wfl); human serum albumin is added; active ingredient is dissolved with heating; made up to specified volume with Wfl; transferred into ampoules under nitrogen gas.

**Example 9**

15

**Injectable solution containing 100 mg of active substance per 20 ml**

**Composition:**

|  |        |
|--|--------|
| active substance   | 100 mg |
| 20 monopotassium dihydrogen phosphate<br>= $\text{KH}_2\text{PO}_4$                  | 12 mg  |
| disodium hydrogen phosphate<br>= $\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$ | 2 mg   |
| sodium chloride  | 180 mg |
| 25 human serum albumin   | 50 mg  |
| Polysorbate 80   | 20 mg  |
| water for injections ad  | 20 ml  |

Preparation:

Polysorbate 80, sodium chloride, monopotassium dihydrogen phosphate and disodium hydrogen phosphate are dissolved in water for injections (WfI); human

- 5 serum albumin is added; active ingredient is dissolved with heating; made up to specified volume with WfI; transferred into ampoules.

Example 10

- 10 Lyophilisate containing 10 mg of active substance

Composition:

Active substance 10 mg

Mannitol 300 mg

- 15 human serum albumin 20 mg

Preparation:

Mannitol is dissolved in water for injections (WfI); human serum albumin is added; active ingredient is dissolved with heating; made up to specified volume with WfI;

- 20 transferred into vials; freeze-dried.

Solvent for lyophilisate:

Polysorbate 80 = Tween 80 20 mg

mannitol 200 mg

- 25 water for injections ad 10 ml

Preparation:

Polysorbate 80 and mannitol are dissolved in water for injections (WfI); transferred into ampoules.

Example 11

Tablets containing 20 mg of active substance

5

Composition:

|                       |        |
|-----------------------|--------|
| active substance      | 20 mg  |
| lactose               | 120 mg |
| maize starch          | 40 mg  |
| 10 magnesium stearate | 2 mg   |
| Povidone K 25         | 18 mg  |

Preparation:

Active substance, lactose and maize starch are homogeneously mixed; granulated  
15 with an aqueous solution of Povidone; mixed with magnesium stearate;  
compressed in a tablet press; weight of tablet 200 mg.

Example 12

20 Capsules containing 20 mg active substance

Composition:

|                            |        |
|----------------------------|--------|
| active substance           | 20 mg  |
| maize starch               | 80 mg  |
| 25 highly dispersed silica | 5 mg   |
| magnesium stearate         | 2.5 mg |

Preparation:

Active substance, maize starch and silica are homogeneously mixed; mixed with  
30 magnesium stearate; the mixture is packed into size 3 hard gelatine capsules in a  
capsule filling machine.

Example 13

Suppositories containing 50 mg of active substance

5

Composition:

|                                  |         |
|----------------------------------|---------|
| active substance                 | 50 mg   |
| hard fat (Adeps solidus) q.s. ad | 1700 mg |

10 Preparation:

Hard fat is melted at about 38°C; ground active substance is homogeneously dispersed in the molten hard fat; after cooling to about 35°C it is poured into chilled moulds.

15 Example 14

Injectable solution containing 10 mg of active substance per 1 ml

Composition:

|                         |       |
|-------------------------|-------|
| 20 active substance     | 10 mg |
| mannitol                | 50 mg |
| human serum albumin     | 10 mg |
| water for injections ad | 1 ml  |

25 Preparation:

Mannitol is dissolved in water for injections (Wfl); human serum albumin is added; active ingredient is dissolved with heating; made up to specified volume with Wfl; transferred into ampoules under nitrogen gas.